

CHAPTER 1

Credit and borrowing

Are you ready?

- 1 a 0.40 b 0.12 c 0.08
d 0.024 e 0.003 f 0.075
g 0.0025 h 0.0002
- 2 a \$1500 b \$369.50 c \$9250
d \$16.20 e \$410 f \$46.80
- 3 a \$2520 b \$7475
c \$16 875 d \$2340
- 4 a $n = 5, r = 6\% = 0.06$
b $n = 8, r = 4.5\% = 0.045$
c $n = 12, r = 2.2\% = 0.022$
d $n = 120, r = 0.6\% = 0.006$
e $n = 30, r = 0.058\% = 0.00058$
- 5 a \$9881.07 b \$108 184.55
c \$5439.07 d \$194 445.84
- 6 a $d = 10$ b $A = 45$
c $s = 32.75$

Exercise 1A — Flat rate interest

- 1 a \$700 b \$1200
c \$7500 d \$2850
e \$390
- 2 \$1584
- 3 \$5000
- 4 a \$4060 b \$21 330
c \$1803.75 d \$308.25
e \$275 000
- 5 a \$1650 b \$3850
c \$693 d \$6193
- 6 a \$1600 b \$6600 c \$137.50
- 7 a \$800 b \$2800 c \$53.85
- 8 a \$2000 b \$6000 c \$2160
d \$8160 e \$226.67
- 9 \$43.33
- 10 B
- 11 C
- 12 8%
- 13 a \$2400 b \$9600
c \$16 319.88 d 15%
- 14 15%
- 15 a \$1515.79 b \$2133.33
- 16 2 years
- 17 B
- 18 B
- 19 a The Big Bank offers the best rates.
b The Big Bank charges $11\frac{1}{3}\%$ p.a. for a loan while the Friendly Building Society charges 12%.
- 20 It would be to Michael's financial advantage to invest his winnings. As the loan is a flat rate loan, making a lump sum payment will not reduce the amount of interest that he must pay. If Michael invests, he will earn some interest, which would be to his financial advantage.

Exercise 1B — Home and personal loans

- 1 a \$800 b \$79 950
- 2 a \$1125, \$179 456.38 b \$543.62
c \$1121.60, \$178 909.36 d \$547.02

3

Month	Principal (\$)	Interest (\$)	Balance (\$)
1	150 000.00	1200.00	149 791.99
2	149 791.99	1198.34	149 582.32
3	149 582.32	1196.66	149 370.96
4	149 370.96	1194.97	149 157.92
5	149 157.92	1193.26	148 943.18
6	148 943.18	1191.55	148 726.71
7	148 726.71	1189.81	148 508.51
8	148 508.51	1188.07	148 288.57
9	148 288.57	1186.31	148 066.87
10	148 066.87	1184.53	147 843.40

4 a

Month	Principal (\$)	Interest (\$)	Balance (\$)
1	255 000.00	1912.50	254 618.19
2	254 618.19	1909.64	254 233.52
3	254 233.52	1906.75	253 845.96
4	253 845.96	1903.85	253 455.49
5	253 455.49	1900.92	253 062.10
6	253 062.10	1897.97	252 665.75
7	252 665.75	1894.99	252 266.44
8	252 266.44	1892.00	251 864.13
9	251 864.13	1888.98	251 458.80
10	251 458.80	1885.94	251 050.43
11	251 050.43	1882.88	250 639.00
12	250 639.00	1879.79	250 224.48

b

Month	Principal (\$)	Interest (\$)	Balance (\$)
1	255 000.00	1912.50	254 412.50
2	254 412.50	1908.09	253 820.59
3	253 820.59	1903.65	253 224.25
4	253 224.25	1899.18	252 623.43
5	252 623.43	1894.68	252 018.11
6	252 018.11	1890.14	251 408.24
7	251 408.24	1885.56	250 793.80
8	250 793.80	1880.95	250 174.76
9	250 174.76	1876.31	249 551.07
10	249 551.07	1871.63	248 922.70
11	248 922.70	1866.92	248 289.62
12	248 289.62	1862.17	247 651.79

c \$2572.69

5 \$243 123

6 a \$302 308.80 b \$241 500

7 A

8 B

9 a \$112 034 b \$86 072

c \$61 789.40 d \$39 329.60

10 a Smith family pays \$24 000; Jones family pays \$36 000

b

Month	Smith family			Jones family		
	Principal (\$)	Interest (\$)	Balance (\$)	Principal (\$)	Interest (\$)	Balance (\$)
1	200 000.00	1583.33	199 583.33	200 000.00	1583.33	198 583.33
2	199 583.33	1580.04	199 163.37	198 583.33	1572.12	197 155.45
3	199 163.37	1576.71	198 740.08	197 155.45	1560.81	195 716.27
4	198 740.08	1573.36	198 313.44	195 716.27	1549.42	194 265.69
5	198 313.44	1569.98	197 883.42	194 265.69	1537.94	192 803.62
6	197 883.42	1566.58	197 450.00	192 803.62	1526.36	191 329.98
7	197 450.00	1563.15	197 013.14	191 329.98	1514.70	189 844.68
8	197 013.14	1559.69	196 572.83	189 844.68	1502.94	188 347.62
9	196 572.83	1556.20	196 129.03	188 347.62	1491.09	186 838.70
10	196 129.03	1552.69	195 681.72	186 838.70	1479.14	185 317.84
11	195 681.72	1549.15	195 230.87	185 317.84	1467.10	183 784.94
12	195 230.87	1545.58	194 776.44	183 784.94	1454.96	182 239.91

c \$12 536.53

11 a

Month	Principal	Interest	Balance
1	\$3500	\$22.17	\$3315.82
2	\$3315.82	\$21.00	\$3130.47
3	\$3130.47	\$19.83	\$2943.94
4	\$2943.94	\$18.64	\$2756.24
5	\$2756.24	\$17.46	\$2567.34
6	\$2567.34	\$16.26	\$2377.25
7	\$2377.25	\$15.06	\$2185.96
8	\$2185.96	\$13.84	\$1993.45
9	\$1993.45	\$12.63	\$1799.73
10	\$1799.73	\$11.40	\$1604.78
11	\$1604.78	\$10.16	\$1408.59
12	\$1408.59	\$ 8.92	\$1211.16
13	\$1211.16	\$ 7.67	\$1012.48
14	\$1012.48	\$ 6.41	\$ 812.55
15	\$ 812.55	\$ 5.15	\$ 611.34
16	\$ 611.34	\$ 3.87	\$ 408.86
17	\$ 408.86	\$ 2.59	\$ 205.10
18	\$ 205.10	\$ 1.30	\$ 0.05

b \$214.35

12 a \$92 316 b \$22 959.60 c \$11 436.60

13 a \$2400 b \$299 583.98

c \$2396.67 d \$1.47

14 \$856.94

15 a \$418 321.14 b \$416 626.69 c \$750

16 a \$1166.67, \$199 369.01

b \$1329.13

c Monica can repay the loan over a longer period of time as her repayments are still greater than the monthly interest.

Exercise 1C — The cost of a loan

1 11.6%

2 a 11.6% b 8.3% c 15.2%

d 10.6% e 12.2%

3 a 8.32% b 8.66% c 9.01%

d 9.39% e 11.59% f 18.30%

4 a \$213 996 b \$128 996 c 6.07%

5 9.01%

6 Loan 1

7 a \$231 546 b \$200 745.60

c \$145 593.60

8 Loan 2 – they will save \$6041

9 C

10 a \$341 376

b \$337 578

11 D

12 a \$562 279.20 b 6.25% c 5.7%

13 a \$14 400 b \$533.33 c \$8000.19

14 a \$7600 b \$203.83 c \$4097.17

15 8.447%

16 C

17 B

Exercise 1D — Credit cards

- 1 \$136.50
- 2 a \$175 b \$59.73 c \$24.64
d \$10 e \$46.03
- 3 27.75
- 4 \$18.13
- 5 a \$1800 b \$31.50 c \$1831.50
d \$1863.55
- 6 a \$1767.50 b \$88.38 c \$20.26, \$2046.68
- 7 a \$296.40, \$256.40 b \$4.12, \$260.52
- 8 a 0.0452% b \$19.34 c \$73.34
d \$1411.36
- 9 a \$1000 b \$15 c \$530.23
d \$17.50 e \$11.87 f \$535.55
- g The card with the interest-free period
- 10 \$400
- 11 a \$0 b \$13.32
- 12 17.51% p.a.
- 13 a \$15.68
b Kylie should not accept the offer as she will be charged \$21.7 in interest over 2 months compared to \$15.68 with her current card.
- 14 Card A charges 18% p.a. on \$500 unpaid balance, which equals \$7.50 per month interest. Card B charges 12% p.a. on \$1000 each month, which equals \$10 per month interest. Rob should choose Card A.

Exercise 1E — Loan repayments

- 1 \$674.25
- 2 a \$90.46 b \$341.25
c \$819.84 d \$1101.00
e \$1515.54
- 3 a \$400
b \$3600
c \$123.05
- 4 They will not need to increase their repayments.
- 5 a \$1510.20 b \$1620.14
- 6 Yes. The repayment is \$744 and the most he can afford is \$750.
- 7 a \$7000 b \$1750 c \$178 000
- 8 a \$733.40 b \$174.80
- 9 a \$2895 b \$868 500 c \$493 500
d \$19 740 e 5.264%
- 10 a \$1696.80 b \$509 040 c \$269 040
d 4.484% e i 4.3% ii 4.12%
- 11 a \$2121 b \$2316 c \$2340 d \$45
- 12 \$268
- 13 a \$2000 b \$238 000
- 14 a \$2325 b \$2508 c \$2416.50 d \$2370.75
- 15 a \$2517 b 5 years c \$151 020
- 16 a \$2508
b \$601 920
c Marcus would only need to pay \$2450 to pay the loan off in 18 years, so he will achieve this.

Chapter review

Multiple choice

- 1 C 2 C 3 A 4 D

Short answer

- 1 a \$1120 b \$7187.50 c \$1281.60
d \$39.60 e \$12 285.00
- 2 \$6760
- 3 \$191.02
- 4 6.15%
- 5 a \$1250
b \$124 873.64

6 a

Month	Principal (\$)	Interest (\$)	Balance (\$)
1	130 000.00	866.67	129 779.30
2	129 779.30	865.20	129 557.12
3	129 557.12	863.71	129 333.47
4	129 333.47	862.22	129 108.32
5	129 108.32	860.72	128 881.67
6	128 881.67	859.21	128 653.51
7	128 653.51	857.69	128 423.83
8	128 423.83	856.16	128 192.62
9	128 192.62	854.62	127 959.87
10	127 959.87	853.07	127 725.56
11	127 725.56	851.50	127 489.70
12	127 489.70	849.93	127 252.26

b

Month	Principal (\$)	Interest (\$)	Balance (\$)
1	130 000.00	866.67	129 366.67
2	129 366.67	862.44	128 729.11
3	128 729.11	858.19	128 087.31
4	128 087.31	853.92	127 441.22
5	127 441.22	849.61	126 790.83
6	126 790.83	845.27	126 136.10
7	126 136.10	840.91	125 477.01
8	125 477.01	836.51	124 813.52
9	124 813.52	832.09	124 145.61
10	124 145.61	827.64	123 473.25
11	123 473.25	823.16	122 796.40
12	122 796.40	818.64	122 115.05

c \$5137.21

- 7 a 7.25% b 13.70%
c 25.65% d 14.11%
- 8 a \$18 223.20 b \$4723.20 c 7%
- 9 Loan 2
- 10 \$21.15
- 11 \$17.00
- 12 \$3.21
- 13 a 0.0534% b \$34.82
c \$102.98 d \$32.82
- 14 a \$316.75 b \$599.40
c \$2110.45 d \$5100
- 15 a \$2453.49 b \$2618.06

Extended response

- 1 a \$4140 b \$6292.80
c \$30.25 d 15.76%
- 2 a \$1678.50 b \$402 840
c \$1825.34 d \$422 193.55
- 3 a \$13.78 b \$261.72 c \$4.58
d The card with this interest-free period is cheaper as the card without the interest-free period would have charged \$6.75 interest.

CHAPTER 2

Further applications of area and volume

Are you ready?

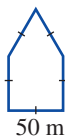
- 1 a 50.3 cm² b 1206.9 cm²
 c 63.6 cm² d 304.8 cm²
 2 a 20.25 cm² b 40.33 cm² c 52.44 cm²
 3 a 5832 cm² b 2376 cm² c 624 cm³
 4 a 3820 cm³ b 7238.2 cm³
 5 163.3 cm³
 6 a 14.5 cm – 15.5 cm b 8.25 m – 8.36 m
 c 4750 km – 4850 km

Exercise 2A — Area of parts of the circle

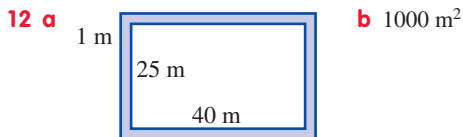
- 1 128.7 cm²
 2 a 254.47 cm² b 3421.19 mm²
 c 172.03 m² d 2206.18 cm²
 e 46.32 m² f 113.85 m²
 3 176.7 m²
 4 40.7 m²
 5 a 14.16 cm² b 6451.26 mm²
 c 92.33 m² d 110.79 mm²
 e 796.39 m² f 955.67 mm²
 6 827.3 cm²
 7 339.3 cm²
 8 a 239 cm² b 240 m² c 18 100 mm²
 9 a 2.5 m b 3.5 m c 18.8 m²
 10 188.5 cm²
 11 a 5892 mm² b 308 m² c 924 cm²
 12 B
 13 B
 14 A
 15 a 78.5 m² b 122.5 m² c 25.5 m²
 16 a 314.16 cm² b 5 cm c 157.08 cm²
 17 a 750 m² b 117.8 m² c 15.7%
 18 a 1571 m²
 b Tori is incorrect. Your explanation should include another example of two radii differing by 10 m, giving a different answer to that in part (a).
 19 a 3.2 cm
 b The semi-major axis is the 5 cm axis as it is the larger one; hence, the semi-minor axis is the 3.2 cm axis.
 20 57°
 21 a 75.4 cm² b Frank is not correct. c 4.9 cm

Exercise 2B — Area of composite shapes

- 1 248 m²
 2 a 222 cm² b 375 cm² c 335 cm²
 d 228.5 cm² e 44.6 cm² f 130.3 cm²
 3 a 8 cm b 84 cm²
 4 a 5.3 m b 31.8 m²
 5 a 120 m² b 168 cm² c 6658.2 mm²
 6 a 174 cm² b 510 m² c 4032 mm²
 7 A
 8 B
 9 a b 250 m c 3582.5 m²



- 10 a 80 m² b 109.7 cm²
 c 12.2 cm² d 58.4 cm²
 e 4600 mm² f 20.1 m²
 11 2513 m²



- c 134 m² d \$2345
 13 a 306 cm² b 625 cm² c 1428.3 cm²
 d 1147.6 cm² e 17 121.8 mm² f 670.9 cm²
 14 a 200 cm² b 350 m² c 50 cm²
 d 35 000 mm² e 0.0134 km² f 37.5 ha
 g 2750 m² h 43 000 m²
 15 14.98 m²
 16 661 mm²
 17 a 12.6 m² b 9.4 m²
 18 a 1026 m² b 10.6 m² c 266 m²
 d 4209.1 mm² e 1252 cm² f 172.9 m²

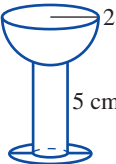
Exercise 2C — Simpson's rule

- 1 a 30 m
 b $d_f = 40$ m, $d_m = 9$ m, $d_l = 18$ m
 c 940 m²
 2 a 1296 m² b 1560 m² c 936 m²
 3 a 620 m² b 880 m² c 1500 m²
 4 a 2535 m² b 1184 m² c 2934 m²
 5 C
 6 B
 7 2514 m²
 8 a 2970 m² b 11 840 m² c 1386 m²
 9 a 768 m² b 640 m²
 10 2484 m²
 11 The figure cannot be divided into an even number of equal strips.
 12 a 63.4 m² b 1585 m³
 13 160 m²
 14 a 226 cm² b 192 cm² c 15.04%
 15 350 trees
 16 300 m³

Exercise 2D — Surface area of cylinders and spheres

- 1 502.7 cm²
 2 a 282.7 cm² b 18.7 m² c 3141.6 cm²
 d 785.4 cm² e 437.4 cm² f 54.9 m²
 3 37.4 m²
 4 452 cm²
 5 a 395.4 cm² b 1616.5 cm²
 c 2199.1 cm² d 367.9 cm²
 e 640.9 cm² f 52.8 m²
 6 314.16 cm²
 7 a 231 cm² b 154 cm²
 8 113 cm²
 9 a 804.2 cm² b 55.4 cm²
 c 2463.0 cm² d 12.6 m²
 e 145.3 cm² f 40.7 m²
 10 5542 cm²
 11 A
 12 B
 13 a 565 cm² b 452 cm²
 14 a 113 cm² b $r = 3$ cm, $h = 18$ cm
 c 28 cm² d 368 cm² e 339 cm²
 15 3041 cm²
 16 4562 cm²
 17 201 cm²
 18 693 cm²
 19 a 5400 cm² b 47.64%

Exercise 2E — Volume of composite solids

- 1 a 178 cm^2 b 712 cm^3 c 3152.68 mm^3
 2 a 630 mm^3 b 420 cm^3 c 1319.47 mm^3
 3 a 700 cm^3 b 3000 cm^3 c 3720 cm^3
 d 2.128 m^3 e 12.75 m^3 f 18 m^3
 4 a 8 m^3 b 2 m^3 c 10 m^3
 5 a $22\,619 \text{ cm}^3$ b 6032 cm^3 c $28\,651 \text{ cm}^3$
 6 a $19\,000.4 \text{ cm}^3$ b 103.7 cm^3 c $157\,724.9 \text{ cm}^3$
 7 B 8 D
 9 a $16\,875 \text{ cm}^3$ b 16.875 L
 10 a  2.5 cm b 50 mL c 20

- 11 a 8.64 m^2 b 86.4 m^3
 12 a 8 cm b 332 cm^3 c 35%
 13 5.76 g
 14 a 3054 cm^3 b 840 cm^3 c 48 cm^3
 d 42 m^3 e $10\,379 \text{ cm}^3$ f 312 m^3
 g 9448 m^3 h 33 m^3
 15 770 mL
 16 a 26 cm b 862.8 cm^3 c 575.2 cm^3
 d 287.6 cm^3 e $\frac{2}{3}$
 17 B
 18 a 314 m^2
 b i 628 m^2 ii 2094 m^3
 c i 1414 m^2 ii 7069 m^3

Exercise 2F — Error in measurement

- 1 a 1152 cm^3 b 188.625 cm^3
 2 a 0.05 cm b 181.5 cm^2
 c 2.4 cm^2 d 1.3%
 3 a 4096 mm^3 b 3723.875 mm^3
 c 4492.125 mm^3 d 9.7%
 e 1536 mm^2 f 1441.5 mm^2
 g 1633.5 mm^2 h 6.3%
 4 a 302 cm^3 b 212 cm^3 c 414 cm^3 d 37%
 5 24%
 6 a 11.5 m^3 b 1.3 m^3 c 11.3%
 d 24.6 m^2 e 1.8 m^2 f 7.3%
 7 a 382 L b 89 L c 23%
 8 a $39\,032 \text{ cm}^3$ b 7890 cm^2
 c $60 \text{ cm} \times 40 \text{ cm} \times 20 \text{ cm}$
 d 23% e 11.5%
 9 a 27.72 m^2 b 28 L c 1 L
 10 a $17 \text{ m} \times 10 \text{ m}$ b 170 m^2
 c $\$5142.50$ d $\$221.43$
 11 a 1025 b 128
 12 a 70 m b 70.4 m c 69.6 m d 0.57%
 13 a 2.17% b 0.74%
 14 a 9425 cm^3 b 7500 mL
 15 a 145.3 cm^2 b 19.4 cm
 c i 7.5% ii 4%
 16 a 2910 m^2 b 2832 m^2 c 2989 m^2 d 2.7%

Chapter review

Multiple choice

- 1 D 2 B 3 A 4 C

Short answer

- 1 a 43.0 cm^2 b 8494.9 mm^2 c 2.3 m^2
 2 a 2215.9 mm^2 b 18.1 m^2 c 323.2 cm^2
 3 a 7147.1 mm^2 b 37.7 m^2 c 2723.8 cm^2

- 4 a 4241.2 mm^2 b 329.5 m^2 c 19.8 cm^2
 5 705 cm^2
 6 a 5.75 m^2 b 27 cm^2 c 1804.94 cm^2
 7 1722 m^2
 8 a 840 m^2 b 2672 m^2 c 5548 m^2
 9 4190 m^2
 10 2010 m^2
 11 a 747.7 cm^2 b 728.8 cm^2 c 11.7 m^2
 12 488 cm^2
 13 a 314 cm^2 b 72 m^2 c $76\,454 \text{ mm}^2$
 14 3.438 m^3
 15 a 5797 cm^3 b $14\,283 \text{ cm}^3$ c 1260 cm^3
 16 5343.85 cm^3
 17 a 0.25 cm b 2145 cm^3 c 9.7%
 18 a 500 mL b 20%

Extended response

- 1 a 12.6 m^2 b 62.8 m^3 c $62\,800 \text{ mL}$
 d 125.7 m^2
 2 a 292 m^2 b $233\,600 \text{ m}^3$ c 6.25%

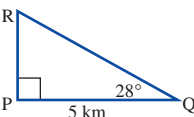
CHAPTER 3

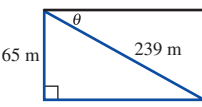
Applications of trigonometry

Are you ready?

- 1 a 14.26 m b 19.30 km c 20.62 m
 2 a 44° b 56° c 37°
 3 a 63° b 53° c 47°
 4 a 7.408 km b 27 M
 c 2222.4 m d 1.92 M
 5 a 32° b 46° c 7°
 6 a $x = 15$ b $x = 1.5$
 c $x = 14.25$ d $x = 22.5$

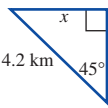
Exercise 3A — Review of right-angled triangles

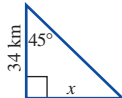
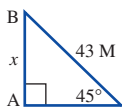
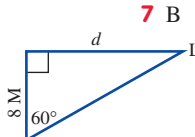
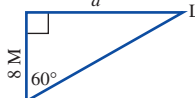
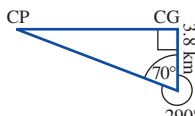
- 1 a 12.2 cm b 110.9 mm c 10.0 m
 d 409.9 mm e 29.8 m f 19.3 cm
 2 a 27° b 56° c 57°
 3 62 m
 4 a 

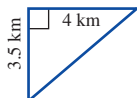
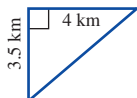
- b 2.659 km
 c 5.663 km
 5 15°
 6 a  b 16°

- 7 a 28.01 m b 25°
 8 52° 9 D
 10 $\theta = 20^\circ$, $x = 4.0 \text{ m}$
 11 59° 12 56°
 13 a 1.43 m b 12°
 14 41°

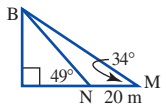
Exercise 3B — Bearings

- 1 a N 25° E b S 10° W c N 50° W
 d S 78° W e N 78° E f S 78° E
 2 a 135° T b 247.5° T c 135° T
 d 292.5° T e 202.5° T f 247.5° T
 3 a  b 2.970 km

- 4 a  b 34 km
- 5 a  b 30.4 M
c 56.3008 km
- 6 B  7 B
- 9 a  b 13.9 M
- 10 437 km
- 11 a  b 11.1 km

- 12 D 
- 14 a 
- 15 342°
- 16 a 276.6 m north, 64.28 m east
b 154.44 m north, 249.80 east
c 38.49 km south, 17.43 km west
d 227.28 m south, 623.47 m east
- 17 a 1428 m b 1358 m c 1970 m
d N43°34'E
- 18 a 141.42 km b 58.58 km
- 19 21 km 20 26.7 m

Exercise 3C — Using the sine rule to find side lengths

- 1 a $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
b $\frac{x}{\sin X} = \frac{y}{\sin Y} = \frac{z}{\sin Z}$
c $\frac{p}{\sin P} = \frac{q}{\sin Q} = \frac{r}{\sin R}$
- 2 a 14.8 cm b 1.98 mm c 112 mm
3 a 10.0 mm b 22.1 cm c 39.6 km
4 B 5 C 6 9.8 cm
7 27.0 m 8 37.8 m
- 9 a  b 43.2 m c 33 m

- 10 a $\angle WYX = 40^\circ$
In $\triangle WYX$ $\frac{80}{\sin 40^\circ} = \frac{XY}{\sin 30^\circ}$
 $\therefore XY = \frac{80 \sin 30^\circ}{\sin 40^\circ}$
- b In $\triangle YXZ$ $\sin 70^\circ = \frac{h}{XY}$ c 58.5 m
 $\therefore h = \frac{80 \sin 30^\circ}{\sin 40^\circ} \times \sin 70^\circ$
- 11 a 145 cm b 34 cm

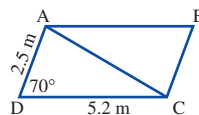
- 12 68 km
- 13 a Lighthouse, 11.6 km b Lighthouse, 6.5 km
c Tower A, 15.4 km
- 14 a 20.38 km b 23.04 km
- 15 Tower A (300 km) Tower B

Exercise 3D — Using the sine rule to find angles

- 1 a 43° b 35° c 27°
d 75° e 37° f 2°
- 2 B 3 B
- 4 a 43° b 50° c 32°
5 38° 6 20° 7 84°
8 a 57° b 63°
9 54°
- 10 51°, 97°, 31.84 cm
- 11 C 12 B 13 199.47° 14 63°
15 230 m, 103°T

Exercise 3E — Area of a triangle

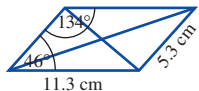
- 1 a Area = $\frac{1}{2}ab \sin C$ b Area = $\frac{1}{2}yz \sin X$
c Area = $\frac{1}{2}am \sin G$
- 2 a Area = $\frac{1}{2}ab \sin C$ b Area = $\frac{1}{2}bh$
c Area = $\frac{1}{2}bh$ d Area = $\frac{1}{2}bh$
- 3 a 42.4 cm² b 3522.6 mm² c 4660.9 mm²
4 a 133 cm² b 555.4 cm² c 608 cm²
5 D 6 B 7 3.865 cm²
8 a b 12.2 m²



- 9 a 72° b 59 cm²
10 710 m² 11 43.3 cm²
12 C 13 B
14 a 130.4 cm² b 14.5 m
15 a 159.4 cm² b Check with your teacher.
c Because $\sin 75^\circ = \sin 105^\circ$
16 90°

Exercise 3F — Using the cosine rule to find side lengths

- 1 a $a^2 = b^2 + c^2 - 2bc \cos A$
b $r^2 = p^2 + q^2 - 2pq \cos R$
c $n^2 = l^2 + m^2 - 2lm \cos N$
- 2 a 8.05 m b 14.3 cm c 12.0 m
3 a 185.1 cm b 14.4 m c 104.4 mm
4 D 5 A 6 C
7 14.4 cm 8 1140 mm 9 6.742 km
10 40 m

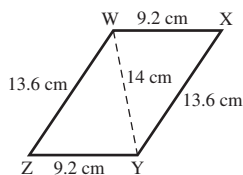


- 11 a c 15.5 cm
12 55 cm 13 13.6 m
14 9.2 cm 15 2218 m
16 27.65 m 17 80.98 km

Exercise 3G — Using the cosine rule to find angles

- 1 a $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ b $\cos Q = \frac{p^2 + r^2 - q^2}{2pr}$
c $\cos P = \frac{a^2 + m^2 - p^2}{2am}$

- 2 a 85° b 83° c 45°
 3 a 103° b 137° c 10°
 4 A 5 D 6 42° 7 23°
 8 $82^\circ, 54^\circ, 44^\circ$ b 73°
 9 a



- 10 32°
 11 a 38.94° b 25.26°
 12 148°
 13 a 12.57 km b $S34^\circ 1'E$
 14 a $35^\circ 6'$ b 6.73 m^2
 15 22.94°
 16 a 130 km b $S22.2^\circ E$
 17 $70^\circ 49'$ 18 1.14 km/h

Exercise 3H — Radial surveys

- 1 102 m
 2 a 286 m b 432 m c 540 m
 3 12 992 m^2
 4 a 4923 m^2 b 8861 m^2 c 18 382 m^2
 5 a 85° b 75 m
 6 389 m
 7 a 214 m b 531 m c 301 m
 8 a 2719 m^2 b 12 425 m^2 c 5809 m^2
 9 a 1017.58 m^2 b 148.16
 c You should obtain the same result.
 10 a 14.14 m b $50 \text{ m}^2, 200 \text{ m}^2$
 c You should obtain the same result.
 11 a 67.26 m b 1563.65 m^2 c 46.5 m
 12 b i 100 m ii 66 m iii 50 m
 iv 90 m v 86 m
 c i 270° ii 310° iii 240°
 d 4300 m^2
 13 a Radial b Check with your teacher.
 c A, 123° ; B, 136° ; C, 152° ; D, 180°
 d 3160 m^2
 14 a Check with your teacher.
 b i 212° ii 270°
 c i 107 m ii 77 m
 d 3800 m^2

Chapter review

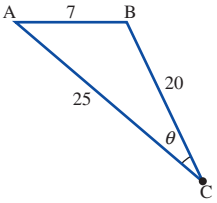
Multiple choice

- 1 D 2 B 3 A 4 D

Short answer

- 1 a 8.6 cm b 13.6 km c 11.2 cm
 2 a 61° b 66° c 45°
 3 3087 m
 4 a 106 m b 28°
 5 56.569 km 6 21.7 km
 7 a 297° b 117°
 8 a 1.67 cm b 81.7 mm c 9.81 km
 9 12.4 cm
 10 a 52° b 21° c 68°
 11 809 cm^2 12 3000 m^2
 13 a 8.64 m b 8.80 m c 11.8 cm
 14 84.0 cm 15 985 m
 16 a 60° b 112° c 139°
 17 34° 18 29°
 19 a 284 m b 4020 m^2
 20 a 783 m b 34 910 m^2

Extended response

- 1 a  b Approximately at an angle of 13°
 2 a $\angle ABT = 15^\circ$ b $BT = \frac{30 \sin 20^\circ}{\sin 15^\circ}$
 c $h = \frac{30 \sin 20^\circ}{\sin 15^\circ} \times \sin 35^\circ$ d Approximately 22.7 m
 3 a Approximately 100.3 m b Approximately 162.5 m^2

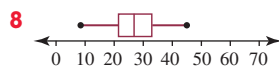
CHAPTER 4

Interpreting sets of data

Are you ready?

- 1 a Mean = 5 b Mean = 19.5 c Mean = 3.31
 2 a 3 b 12 and 30 c 3
 3 a Median = 4.5 b Median = 17
 c Median = 3
 4 a 6 b 21 c 4
 5 a 3.5 b 15 c 1
 6 a Sample standard deviation = 1.32
 b Population standard deviation = 1.41
 7 Key: 1 | 9 = 19

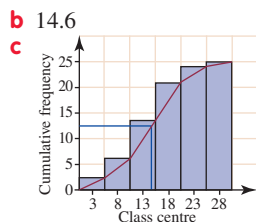
Stem	Leaf
0	9
1	1 4 5 9 9
2	0 1 2 2 3 3 6 6 7 7 7 8 8
3	0 1 2 2 3 4 7 8 9
4	0 0 1 5



Exercise 4A — Measures of location and spread

- 1 a 1.6 b 1
 2 a Mean = 49, median = 44, mode = no mode
 b Mean = 3.4, median = 3.5, mode = 1
 c Mean = 9.575, median = 9.7, mode = 9.8, 9.9
 d Mean = 15.2, median = 15, mode = 15, 16
 3 a 6.5 b 6.5 c 7
 4 a

Score	Class centre	Frequency	Cumulative frequency
1–5	3	2	2
6–10	8	4	6
11–15	13	8	14
16–20	18	7	21
21–25	23	3	24
26–30	28	1	25

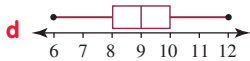


Median ≈ 14

5 a 7 b 1 c Mean = 27.3, $\sigma_n = 1.7$

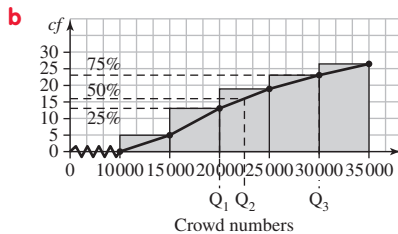
6 a 6
b i 9 ii Lower quartile = 8, upper quartile = 10
iii 2

c i Mean = 9.04 ii $\sigma_n = 1.44$



7 a

Crowd	Class centre	Frequency	Cumulative frequency
5000–10 000	0	0	0
10 000–15 000	12 500	5	5
15 000–20 000	17 500	8	13
20 000–25 000	22 500	6	19
25 000–30 000	27 500	4	23
30 000–35 000	32 500	3	26



c 9500 d $\bar{x} = 21\ 000$, $\sigma_n = 6300$

8 a Team A = 16, Team B = 16

b i Team A = 10, Team B = 40

ii Team A = 4, Team B = 20

iii Team A = 3.1, Team B = 12.5

c Both teams had the same mean score. However, Team A was more consistent as shown by a lower reading in all three measures of spread.

9 B 10 A 11 A 12 C

13 a i 80 ii 80 iii 80

b i 70 ii 79 iii 80

c The outlier had a great effect on the mean, a small effect on the median and no effect on the mode.

14 The outlier will greatly increase the mean.

15 A

16 a Mean = \$647.00
Median = \$397.50
Mode = \$397.50

b i Increase ii None iii None

c i The median or mode as it is a lower figure, making it look as though they deserve a rise.

ii The mean as it is a much greater figure, making it look as though the employees are well paid.

17 a 12 b 9

c The IQRs (middle 50%) are similar for the two restaurants, but McFeast is busier around lunch time.

18 a Group A: mean = median = mode = 170 cm

Group B: mean = median = mode = 170 cm

b No c Group B

d Group B e Group B

f Group A: range = 20, interquartile range = 0, $\sigma = 5.345$

Group B: range = 120, interquartile range = 20, $\sigma = 32.51$

19 a Electric Mate

b Electric Mate = 197 hours, Hot Wire = 185 hours

c Electric Mate

d Hotwire will last for a more consistent length of time.

e One can be more sure of the performance of Hotwire in terms of longevity, *but* Electric Mate *may* last longer. Final comparison must depend on comparative prices.

20 a Yes

b Check with your teacher.

21 At the first point $\bar{x} = 55.3$ and $\sigma_n = 7.3$, while at the second point $\bar{x} = 99.4$ and $\sigma_n = 21.6$. At the second point speeding is a greater problem as the mean speed is much closer to the limit and the standard deviation is much greater.

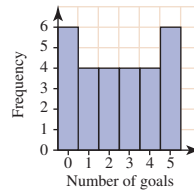
Exercise 4B — Skewness

1 a Yes b 3 c Yes, both equal 3

2 a No b 5–9 and 20–24

c No

3 a



b Yes

c 0 and 5

d Yes, both equal 2.5

4 a 1–2 b Positively skewed

5 a Negatively skewed

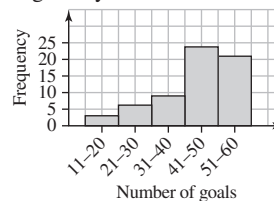
b Symmetrical

c Positively skewed

6 a Positively skewed

b Negatively skewed

7 a

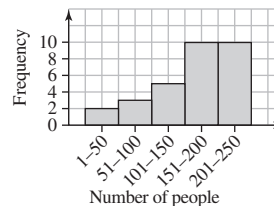


b Negatively skewed

8 A

9 A

10 a



b No

c 151–200 and 201–250

d Negatively skewed

11 a Chemistry is symmetrical.

b Maths is negatively skewed.

c Chemistry: mode = 41–50 and 81–90,
Maths: mode = 71–80

d Maths, because there are more scores further away from the centre of the distribution.

12 Check with your teacher.

13 B

14 a Median b Mean c Median

d Median

- 15 a Negatively skewed
b Symmetrical
c Positively skewed
d Negatively skewed

Exercise 4C — Displaying multiple data sets

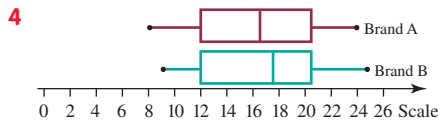
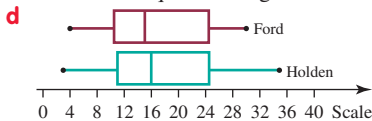
1 Key: $1.5 | 5 = 1.55$

Boys		Girls
9 9 7	1.5	1 2 5 6 7 8 8
9 8 6 6 5 4 0	1.6	4 4 6 7 8 9 9
4 4 2 1	1.7	0

2 Key: $1 | 8 = 18$

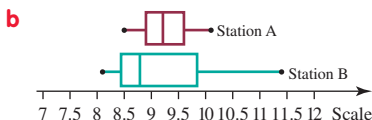
Team 1		Team 2
8	0	7 9
9 8 7	1	
9 5 4 3	2	0 1 3 4 7
4 2	3	0 5 8
2 0	4	1 6

- 3 a Ford: median = 15, Holden: median = 16
b Ford: range = 26, Holden: range = 32
c Ford: interquartile range = 14,
Holden: interquartile range = 13.5

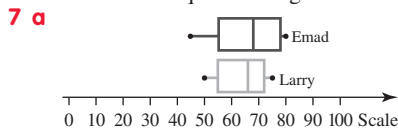


5 a Key: $8 | 5 = 8.5$

Station A		Station B
8 7 5	8	1 2 4 5 7 7 8 9
9 7 5 4 3 2 2 1 0	9	0 2
1	10	5
	11	2 4



- 6 a Team A
b Team A: range = 60, Team B: range = 90
c Team A: interquartile range = 13,
Team B: interquartile range = 11



- b Emad: range = 35, Larry: range = 24
c Emad: interquartile range = 12,
Larry: interquartile range = 14

8 C

- 9 a July
b 13°
c 21.7°

- 10 a Supermarket X, range = 111
Supermarket Y, range = 90
b Both supermarkets follow a similar pattern. There are very few customers from midnight to 6 am. Then the number peaks between 10 am and noon, remaining fairly constant until 8 pm, when the number reduces.

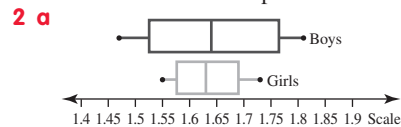
11

Month	Sydney	Melbourne	Brisbane
January	12	8	13
February	12	7	14
March	13	9	15
April	12	12	11
May	12	14	10
June	12	14	8
July	10	15	7
August	10	16	7
September	10	15	7
October	12	14	9
November	11	12	10
December	12	11	12

- 12 a English: 66; Maths: 63.5
b English: 32; Maths: 53
c Marks are more spread in Maths.

Exercise 4D — Comparison of data sets

- 1 a English 66, Maths 63.5
b English 32, Maths 53
c The marks are more spread in Maths than in English.



- b Boys 1.64, girls 1.62
c Boys 0.34, girls 0.18
d Boys 0.14, girls 0.07
e The spread of heights is much greater among boys than among girls.

- 3 a Year 7: range = 0.45, Year 12: range = 0.26
b Year 7: interquartile range = 0.15,
Year 12: interquartile range = 0.11
c The range of heights is greater in Year 7 as shown by the range and the IQR. The heights become less spread by the time they get to Year 12.

- 4 The pattern of software sales follows after the pattern of hardware sales with a slight time delay.

- 5 a Southern
b Western
c Similar peaks and troughs

- 6 a 43.2% b 1.90% c 0.93% d 2.63%
e More evident in males with three times the number of drivers over the limit

- 7 a 90.48% b 55.56%
c Yes, as a much greater percentage of games are won with Ashley playing.

- 8 a 9.5% b 9.7%
c i 48.7% ii 51.3%

- d There is no significant difference between the city and country results.

- 9 a Chemistry, 69.25

- b Physics, because of the lower standard deviation

- 10 a Point A: $\bar{x} = 61$, $\sigma_n = 4.27$,
Point B: $\bar{x} = 58.8$, $\sigma_n = 12.06$

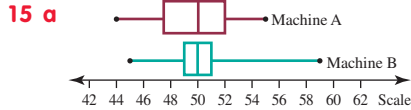
- b Point A because of more people driving over the limit
c Point B because of the greater standard deviation

- 11 a Aaron: $\bar{x} = 38.1$, Sunil: $\bar{x} = 39.3$
 b Aaron: range = 76, Sunil: range = 65
 c Aaron: interquartile range = 16, Sunil: interquartile range = 57
 d Aaron is more consistent because although he has a larger range this is caused by one outlier. Aaron's interquartile range is much less, showing his consistency.

12 C (based on the interquartile range)

13 B

14 A



- b Machine A: $\bar{x} = 49.96$, $s_n = 2.90$, Machine B: $\bar{x} = 50.12$, $s_n = 2.44$
 c Machine B has a lower standard deviation and so is more dependable.

16 D

17

	Men	Women	Total
Live alone	12	23	35
Share with friends	9	16	25
Total	21	39	60

Chapter review

Multiple choice

- 1 B, C and D 2 A 3 A
 4 B 5 C

Short answer

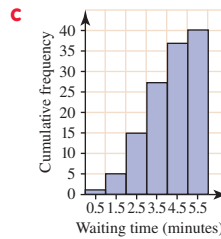
- 1 a 25.4 b 26
 2 a

Number of house calls	Frequency	Cumulative frequency
0	1	1
1	6	7
2	8	15
3	9	24
4	6	30
5	2	32

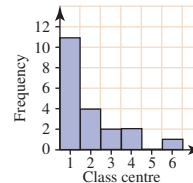
- b 2.593 75 c 3 d 3
 3 a 80.57 b 84 c 20 d 24.4
 4 $\bar{x} = 10.3$, $s_n = 1.64$
 5 a

Waiting time	Class centre	Frequency	Cumulative frequency
0–1 minute	0.5	1	1
1–2 minutes	1.5	4	5
2–3 minutes	2.5	10	15
3–4 minutes	3.5	13	28
4–5 minutes	4.5	9	37
5–6 minutes	5.5	3	40

- b $\bar{x} = 3.35$, $s_n = 1.17$



- d 2
 6 a 29.5 b 34.5
 c Outlier reduces the mean greatly.
 7 a Yes b Both are 17.5.
 c 17 and 18
 8 a b Positively skewed

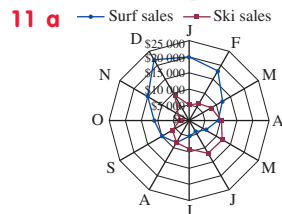


- 9 A histogram that shows more columns to the right of centre than to the left.

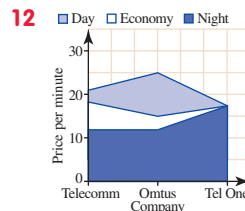
10 a Key: 5 | 6 = 56

English	Maths
5	4 9
7 6 6 2	5 0 1 5 8
8 7 6 6 5 4 0	6 0 1 5 6 6 6 8 9
7 7 4 4	7 0 0 1 1 4
4 2 0	8 5
1	9 9

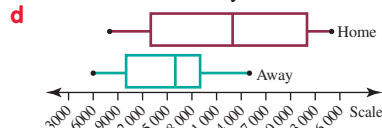
- b English: median = 66.5, Maths: median = 66
 c English: range = 46, Maths: range = 50
 d English: interquartile range = 18.5, Maths: interquartile range = 11.5



- b There is a peak in surf sales through summer, while the ski sales are greatest in winter, with a short peak occurring around Christmas.



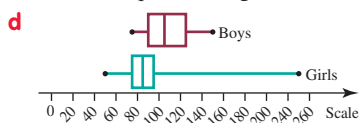
- 13 a Home: 23 000 Away: 16 000
 b Home: 27 000 Away: 19 000
 c Home: 19 000 Away: 9000



- 14 a 2003: median = 7, 2004: median = 8
 b 2004
 c 2003
 d 2004 — Higher median, lower limit, lower quartile and upper limit
- 15 a 9.7% b 8.0%
 c No significant difference
- 16 a English: $\bar{x} = 71$, maths: $\bar{x} = 69.3$
 b English: range = 43, maths: range = 37
 c English: $\sigma_n = 11.64$, maths: $\sigma_n = 11.96$
 d English, because of the lower standard deviation

Extended response

- 1 a Boys: median = \$105, Girls: median = \$85
 b Boys: range = 75, Girls: range = 200
 c Boys: interquartile range = 35, Girls: interquartile range = 20



- e Boys: $\bar{x} = \$107$, $\sigma_n = 22.4$, Girls: $\bar{x} = \$97$, $\sigma_n = 53.1$
 f Generally, the girls' is more consistent. The range and standard deviation for the girls is inflated by the outlier so the best measure of consistency is the interquartile range which is lower for the girls.
- 2 a Sharks: median = 24, Bulldogs: median = 24
 b Bulldogs' scores are more clustered around the mean and so can be seen to be more consistent.
 c Slight positive skew
 d Using a calculator, Sharks mean = 26.12, standard deviation = 10.37
 Bulldogs mean = 23.96, standard deviation = 5.57

CHAPTER 5

Algebraic skills and techniques

Are you ready?

- 1 a 2.5×10^4 b 2.36×10^8
 c 4×10^5 d 2.6×10^{13}
- 2 a 2300 b 161.2 c 3120 d 375.9
- 3 a $5r$ b $10m$ c $16x + 15$
 d $a - 5b$ e $4y - x$ f $9m - 8n$
- 4 a r^{10} b $18a^3$ c $28p^6$
 d $35q^6$ e $48m^6$ f $27r^3s^{11}$
- 5 a d^4 b $6m^4$ c $42x^5$
 d $2q^5$ e $8s^5$ f $\frac{k^2}{8}$
- 6 a a^8 b $64b^3$ c $16c^8$
- 7 a $z = 118$ b $y = 24$ c $w = 13$
 d $v = 5\frac{1}{3}$ e $t = 14$ f $n = 34$

Exercise 5A — Scientific notation

- 1 a 9×10^4 b 2×10^{10} c 7×10^2
- 2 a 1.458×10^6 b 2.365×10^{13} c 2.589×10^3
- 3 a 2×10^{-8} b 4.57×10^{-3} c 4.9321×10^{-11}
- 4 a 9.32×10^7 km b 7.85×10^{10} mm
 c 4.59×10^4 t d 3.65×10^{-3} g
 e 2.14×10^{-1} mL f 5.69×10^{-6} s
- 5 a 34 000 b 2 870 000 c 30 248 000 000
- 6 a 0.000 585 b 0.000 001 97 c 0.001 002

Planet	Distance (AU)	Distance in km (Scientific notation)
Mercury	0.39	5.85×10^7
Venus	0.72	1.08×10^8
Earth	1.0	1.50×10^8
Mars	1.52	2.28×10^8
Jupiter	5.20	7.80×10^8
Saturn	9.54	1.43×10^9
Uranus	19.18	2.97×10^9
Neptune	30.06	4.51×10^9

- 8 a 2.35×10^4 m b 8.4×10^4 km
 c 6.4×10^6 mm d 6.58×10^3 t
 e 7.802×10^9 kg f 8.29×10^{13} g
 g 1.87×10^5 kL h 2.178×10^{10} L
 i 5.55×10^{10} mL
- 9 a 1.53×10^9 b 1.035×10^5
 c 4.68×10^8 d 1.05×10^{30}
 e 5.22×10^4 f $3.513\ 123 \times 10^{16}$
 g 4.0815×10^{10} h 2.1736×10^{13}
 i 2.72×10^{12} j $4.08m \times 10^7$
 k 1.495×10^{42} l 1.5615×10^6
- 10 a 9.0×10^1 b 2.077×10^1
 c 2.0×10^4 d 4.0×10^2
 e 2.6×10^5 f 5.0×10^2
 g 1.73×10^{13} h 2.24104×10^2
 i 1.27×10 j 1.9×10^4
 k 2.41×10^1 l 8.0×10^{13}
- 11 a A
 b C
- 12 1.0×10^7
- 13 9.0×10^6
- 14 8.849×10^3 hours

Exercise 5B — Substitution

- 1 32.16
- 2 a 30.75 b 2327.5 c 27.1
 d 120 e -154
- 3 26.4
- 4 29.8 m
- 5 181.5
- 6 a 1.41 b 12.06 c 137.26
 d 82.80 e 254.04
- 7 126 cm²
- 8 101.25
- 9 6.3
- 10 6.2 cm
- 11 a 10 b 101.87 c 15.3
 d 6.0 e 30.5 c 8.5
- 13 5.2
- 14 a 10.5 b 16.0
- 15 1.02×10^{14}
- 16 2.7×10^{16}
- 17 1.74×10^{15} mm²
- 18 5.6×10^{11}
- 19 a $\frac{1}{10}$ b 2
 c y will decrease as x increases.

Exercise 5C — Algebraic manipulation

- 1 a 12a b 18b c 14c
d 41d e 4e f f
g -7g h 5h i -9i
j 11j k 4k l -2l
- 2 a 11m - 9 b 8n - 4 c 10p² + 4p
d 3r + 11s e 3t - 6 f -u - 6v
g 6w² - 4w³ h 5xz - xy i 5p² - 16
j 10x + 4y - 6xy
- 3 a a¹³ b b⁴ c 12c⁷
d 7d⁴ e 12p⁹q⁵ f 63g³h⁴
g 28m⁶n⁵ h 20p⁵q⁴ i 24x³y³z
j 48u⁴v⁵w⁹
- 4 a k³ b 3m⁵ c 6n⁵
d 2x⁴ e 8m²n² f 5x⁵
g m⁵n⁶ h $\frac{8p^3}{q^3}$ i $\frac{11a}{b}$
j 4qr⁴
- 5 a a¹² b 4b⁸ c 27m⁶
d 16x⁴y⁶ e 16p⁴q⁸
6 a 2m + 10 b x² + 2x
c 9a² + 6ab d 18q⁶ - 6q²
e 5mn - 25n² f 14a⁶b⁴ - 21a²b¹⁰
g -3d - 15 h -3m² + 6mn
i -12r³ + 18r⁶ j 18p²q²r - 6pqr²
- 7 a 10x + 6 b a² + 13a - 10
c 2m² + 4mn - 12n² d 18x - 45
e 4p² - 15p + 30 f 7x²y - 8xy² - xy
- 8 a a⁷ b m³ c 16mn⁵
d 10xy¹¹ e 1 f m
- 9 a -6x - 10 b 9m - 4m² c 2p - 6q
10 a A b D c A d C
- 11 a $\frac{4x}{y}$ b $\frac{3x}{y}$ c $\frac{4y}{x}$ d $\frac{9x}{4y}$
e $\frac{5x}{4y}$ f $\frac{3w}{2x}$ g $\frac{6z}{7x}$ h $\frac{2z}{7x}$
i $\frac{3x}{2y}$ j $\frac{5}{24}$ k $\frac{12z}{x}$ l $\frac{x}{6w}$
- 12 a 3p⁴ b 6r⁴ c 9a³ d 3b⁶
e 20r⁴ f 9q
- 13 a $\frac{3p^5}{2}$ b $\frac{8b^5}{3}$ c $\frac{5m^{10}n^6}{6}$
d $\frac{9x^8y}{4}$ e $\frac{4hk^3}{3}$ f 3j⁵f³
g $\frac{4p^2rs}{3}$ h $\frac{9a^5b^3c}{2}$ i $\frac{20f^6g^2h^4}{3}$
- 14 a $\frac{9b^8}{d^6}$ b $\frac{25h^{20}}{4j^4}$ c $\frac{8k^{15}}{27t^{24}}$
d $\frac{49p^{18}}{64q^{44}}$ e $\frac{125y^{21}}{27z^{39}}$ f $\frac{256a^{12}}{2401c^{20}}$

Exercise 5D — Equations and formulas

- 1 12.7 cm
2 38 m
3 a 7.2 b 12.4 c 4.1
d 26 e 20.4

- 4 5
5 10.22 cm
6 a 0.75 b 2.20 c 3.19
d ±4.70 e 0.6
7 $x = \frac{y-1}{2}$
8 $l = \frac{A}{b}$
9 a $a = \frac{2A}{h} - b$
b $h = \frac{2A}{a+b}$
10 $r = \sqrt{\frac{A}{\pi}}, r > 0$
11 a $m = \frac{E}{c^2}$ b $c = \pm\sqrt{\frac{E}{m}}$
12 D 13 B 14 D
15 a $r = \sqrt{\frac{V}{\pi}}, \dot{r} > 0$ b $u = \pm\sqrt{v^2 - as}$
c $r = \sqrt[3]{\frac{3V}{4\pi}}$ d $L = \frac{gT^2}{4\pi^2}$
e $a = \pm\sqrt{c^2 - b^2}$
16 a $l = \pm\sqrt{A}, 7.746$
b $r = \sqrt[3]{\frac{3V}{4\pi}}, 6.204$
c $v = \pm\sqrt{\frac{mg - F}{k}}, \pm 59.161$
d $a = \frac{v-u}{t}, 4.167$
e $h = \frac{S}{\pi r} - r$ or $h = \frac{S - \pi r^2}{\pi r}, 17.108$
f $l = g\left(\frac{T}{2\pi}\right)^2, 3.976$
g $d = \pm\sqrt{e^2 - 4fl}, 10.247$
h $v = \frac{H-U}{P}, 10.75$
i $c = \frac{(1-\alpha)K}{\alpha^2}, 2622$
j $u = \frac{H_o v}{H_i}, 4.706$
17 a 42 cm b $w = \frac{P}{2} - l$ or $w = \frac{P-21}{2}$
c 40 mm
18 a 10 N b $a = \frac{F}{m}$ c 10.769 m/s²
19 a $f = \frac{uv}{u+v}$ b $u = \frac{fv}{v-f}$ c 150 cm

Exercise 5E — Solution by substitution

- 1 x = 6.6 2 x = 7.2 3 x = 7 4 n = 14
5 a 1.886 79 = 1.04ⁿ b 16 years

6 5 years

7 a

<i>t</i>	1	2	3	4	5	6	7	8	9	10
<i>d</i>	5	20	45	80	125	180	245	320	405	500

b 8 seconds

8 a

Length	5	10	15	20	25	30	35
Width	35	30	25	20	15	10	5
Area	175	300	375	400	375	300	175

b $20\text{ m} \times 20\text{ m} = 400\text{ m}^2$ c $40\text{ m} \times 20\text{ m}$

9 8 years

10 7.2% p.a.

11 5.9% p.a.

12 $x = 5$

13 9 years

14 5 seconds

Chapter review

Multiple choice

- 1 A 2 A 3 A
4 A 5 B

Short answer

- 1 a 6×10^5 b 2×10^{-10}
c 7.892×10^{13} d 1.25×10^{-3}
e 4.589×10^{-6} f 1.24589×10^{14}
2 a 1.26×10^4 b 1.25×10^{-4}
c 3.21×10^{-2} d 5.86×10^8
e 1.24×10^4 f 5.19×10^{-8}
3 a 250 b 38 700
c 98 504 000 d 0.289
e 0.000 000 367 02 f 0.0011
4 a $2.5 \times 10^8\text{ mm}$ b $2.8 \times 10^5\text{ kg}$
c $3.43 \times 10^7\text{ L}$ d $1.45 \times 10^3\text{ km}$
e $4.243 \times 10^{10}\text{ kg}$ f $1.3 \times 10^5\text{ L}$

5 162

6 36.952

7 13

8 a 136.00 b 37.78 c 8.57 d 8

9 a 5m b 16q c 12p

d t e $4m + 4n$ f $4x - 5$

g $3k - 2l$ h $8x^2 + 14x$ i $ab + 7a - 2b$

10 a $28a^9$ b $45b^2$ c $21g^4h^8$

d $12m^6n^7$ e $6x^2$ f $8s^3$

g 7q h $27p^6q^{12}$ i $4m^2$

11 a $2a + 18$ b $2p^2 - 4p$

c $-3x^5 + x^2$ d $12m^7 - 8m^5n$

e $-16xy + 4xy^2$ f $12a^5b^3 - 24a^2b^5$

12 a $8m + 40$ b $2p^2 - 3p$

c $11x - 52$ d $7yz + 8y^2 - 6z^2$

e $2p^2q - 4pq^2 + 8p$

13 15 14 21.6 m 15 $s = \pm 6$

16 7.2 cm

17 a $x = 2.9$ b $x = 3.8$ c $x = 4.8$

18 8 years

19 3 years

Extended response

- 1 a 304.8 cm^3 b 8.3 cm
c 6.4 cm d $h = \frac{SA - 2\pi r^2}{2\pi r}$

2 a $n = 10$ b $(0.85)^n = 0.5$

c $n = 4.3$

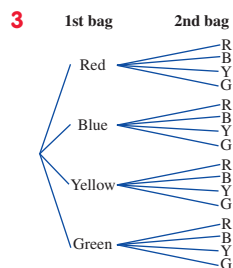
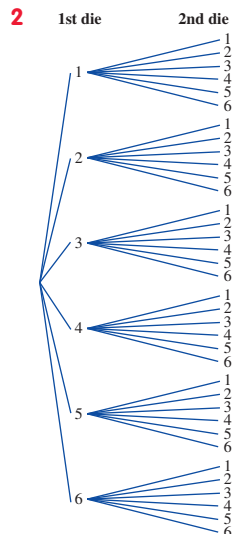
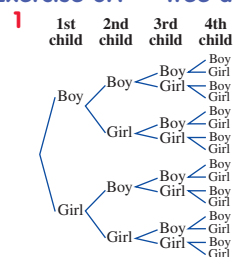
CHAPTER 6

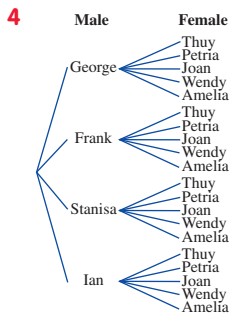
Multi-stage events

Are you ready?

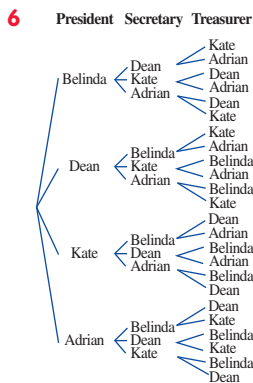
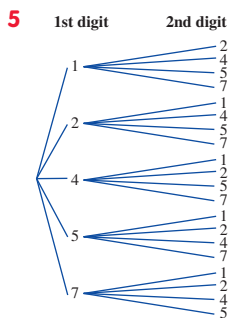
- 1 a {hearts, diamonds, spades, clubs}
b {red, blue, white}
c $\{a, b, c, \dots x, y, z\}$
2 a Unlikely
b Probable
c Impossible
3 a Equally likely b Equally likely
c Impossible
4 a 500
b 240
c 45 697 600
5 a $\frac{1}{8}$ b $\frac{1}{50}$ c $\frac{3}{14}$
6 a Selecting a consonant
b Selecting a white or clear marble
c Selecting a number greater than 9
7 a $\frac{3}{5}$ b $\frac{1}{5}$ c 0.27

Exercise 6A — Tree diagrams





$S = \{\text{George} - \text{Thuy}, \text{George} - \text{Petria}, \text{George} - \text{Joan}, \text{George} - \text{Wendy}, \text{George} - \text{Amelia}, \text{Frank} - \text{Thuy}, \text{Frank} - \text{Petria}, \text{Frank} - \text{Joan}, \text{Frank} - \text{Wendy}, \text{Frank} - \text{Amelia}, \text{Stanisa} - \text{Thuy}, \text{Stanisa} - \text{Petria}, \text{Stanisa} - \text{Joan}, \text{Stanisa} - \text{Wendy}, \text{Stanisa} - \text{Amelia}, \text{Ian} - \text{Thuy}, \text{Ian} - \text{Petria}, \text{Ian} - \text{Joan}, \text{Ian} - \text{Wendy}, \text{Ian} - \text{Amelia}\}$

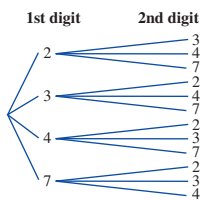


7 $S = \{357, 358, 375, 378, 385, 387, 537, 538, 573, 578, 583, 587, 735, 738, 753, 758, 783, 785, 835, 837, 853, 857, 873, 875\}$

8 C

9 $\frac{1}{2}$

10 a



11 a $\frac{1}{20}$

b $\frac{3}{10}$

c $\frac{2}{5}$

d $\frac{3}{5}$

12 $\frac{1}{4}$

13 B

14 a $S = \{\text{Bris} - \text{Peak} - \text{Ec}, \text{Bris} - \text{Peak} - \text{BC}, \text{Bris} - \text{Peak} - \text{FC}, \text{Bris} - \text{Off-peak} - \text{Ec}, \text{Bris} - \text{Off-peak} - \text{BC}, \text{Bris} - \text{Off-peak} - \text{FC}, \text{GC} - \text{Peak} - \text{Ec}, \text{GC} - \text{Peak} - \text{BC}, \text{GC} - \text{Peak} - \text{FC}, \text{GC} - \text{Off-peak} - \text{Ec}, \text{GC} - \text{Off-peak} - \text{BC}, \text{GC} - \text{Off-peak} - \text{FC}, \text{Cairns} - \text{Peak} - \text{Ec}, \text{Cairns} - \text{Peak} - \text{BC}, \text{Cairns} - \text{Peak} - \text{FC}, \text{Cairns} - \text{Off-peak} - \text{Ec}, \text{Cairns} - \text{Off-peak} - \text{BC}\}$

b i $\frac{3}{8}$

ii $\frac{1}{4}$

iii $\frac{1}{8}$

15 a 6

b 27

c Kevin is correct. In each case the probability is $\frac{1}{3}$ as there is one chance in three that the 8 is in the final position.

16 a $P(\text{more boys}) = \frac{5}{16}$, $P(\text{equal numbers}) = \frac{6}{16}$, $P(\text{more girls}) = \frac{5}{16}$. Each outcome is not equally likely.

b Dan is incorrect. If there are two children, the probability of an equal number of boys and girls is $\frac{1}{2}$.

17 Each number is not equally likely to occur.

18 Tanya is incorrect as the number of choices that she can make is reduced from 96 to 12.

19 $P(\text{at least one head}) = \frac{1023}{1024} \approx 99.9\%$
No. Ingrid is wrong.

Exercise 6B — Counting techniques

1 a 6

b 120

c 362 880

2 24

3 120

4 6

5 720

6 12

7 12 144

8 35

9 210

10 15

11 72

12 C

13 D

14 B

15 a 20

b 6

16 a 362 880

b 504

c 36

17 120

18 3024

19 After the first three places have been filled there is only one place left and only one way of filling it; hence, the number of arrangements is the same.

20 59 400

21 a 8 145 060

b 11 480

c 820

22 When selecting three people from ten people, seven people remain. For every group of three selected there is a corresponding group of seven not selected. Hence the number of groups of three is the same as the number of groups of seven.

Exercise 6C — Probability and counting techniques

1 $\frac{1}{24}$

2 a 120

b $\frac{1}{120}$

c $\frac{1}{120}$

3 a $\frac{1}{6}$

b $\frac{2}{3}$

c $\frac{2}{3}$

4 $\frac{1}{10}$

5 a $\frac{1}{42}$

b $\frac{1}{42}$

c $\frac{1}{21}$

6 a $\frac{1}{72}$

b $\frac{2}{9}$

c $\frac{2}{9}$

7 $\frac{1}{6}$

8 a $\frac{1}{13\ 800}$

b $\frac{1}{2300}$

9 a 20

b $\frac{1}{20}$

10 a $\frac{1}{10}$

b $\frac{3}{10}$

c $\frac{3}{5}$

11 a $\frac{1}{8\,145\,060}$ b i $\frac{7}{8\,145\,060}$ ii $\frac{28}{8\,145\,060}$ iii $\frac{5005}{8\,145\,060}$

12 Lotto is harder to win as Lotto Strike player has a probability of $\frac{1}{3\,575\,880}$ of winning.

13 Bruce is correct as ${}^{45}C_7 = 45\,379\,620$, which is approximately 5.57 times greater than lotto. That is, Oz Lotto is 457% harder to win.

14 a 1 221 759 b 45 c $\frac{1}{54\,979\,155}$

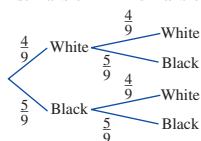
15 a 1.65×10^{12} b 184 756 c 1.12×10^{-7}

16 a 0.06 b 0.014 c 6.45×10^{-4}

Exercise 6D — Probability trees

1 $\frac{25}{64}$

2 a 1st marble 2nd marble



b $P(WW) = \frac{16}{81}$ $P(WB) = \frac{20}{81}$
 $P(BW) = \frac{20}{81}$ $P(BB) = \frac{25}{81}$

3 a $\frac{6}{25}$ b $\frac{12}{25}$

4 a 51.2% b 38.4%

5 a $\frac{1}{20}$ b $\frac{1}{495}$ c $\frac{893}{990}$ d $\frac{19}{198}$

6 C

7 B

8 a $\frac{1}{15}$ b $\frac{7}{15}$ c $\frac{8}{15}$ d $\frac{7}{15}$

9 a $S = \{BB, BG, GB, GG\}$

b i $\frac{14}{39}$ ii $\frac{5}{39}$ iii $\frac{20}{39}$

10 a $\frac{24}{49}$ b $\frac{25}{49}$

11 a $\frac{2}{21}$ b $\frac{3}{7}$ c $\frac{10}{21}$

12 a 0.3025 b 0.2025

13 a 0.4096 b 0.5904

14 0.01

15 a $\frac{624}{625}$ b $\frac{369}{625}$

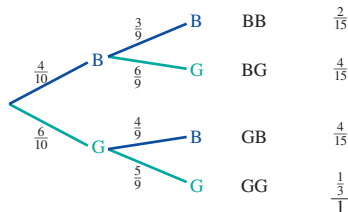
16 D

17 a $\frac{1}{2}$ b $\frac{1}{5}$ c $\frac{1}{2}$

18 $\frac{3}{10}$

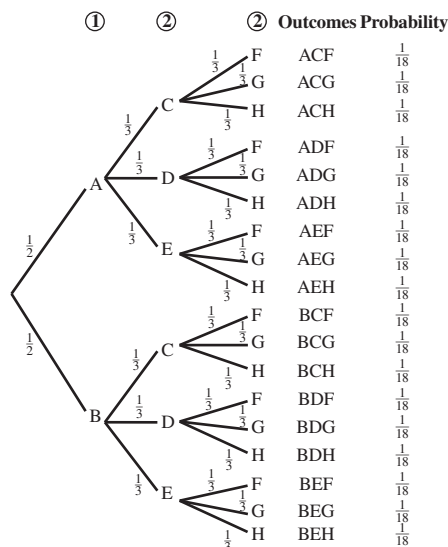
19 a 0.32 b 0.56 c 0.88

20 a ① ② Outcomes Probability



b $\frac{2}{15}$ c $\frac{1}{3}$ d $\frac{8}{15}$ e No

21 a



b $\frac{1}{3}$ c $\frac{1}{9}$
 22 a $\frac{16}{25}$ b $\frac{64}{125}$ c $\frac{1}{25}$ d $\frac{4}{25}$
 23 a $\frac{3}{77}$ b $\frac{48}{77}$ c $\frac{8}{77}$ d $\frac{18}{77}$

24 0.9

25 $\frac{1}{14}$

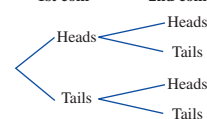
Chapter review

Multiple choice

1 C 2 D 3 C 4 B

Short answer

1 a 1st coin 2nd coin



b $S = \{HH, HT, TH, TT\}$
 2 a $S = \{57, 58, 59, 75, 78, 79, 85, 87, 89, 95, 97, 98\}$
 b $S = \{55, 57, 58, 59, 75, 77, 78, 79, 85, 87, 88, 89, 95, 97, 98, 99\}$

3 a $\frac{1}{8}$ b $\frac{3}{8}$ c $\frac{1}{2}$

4 a $S = \{46, 47, 48, 49, 64, 67, 68, 69, 74, 76, 78, 79, 84, 86, 87, 89, 94, 96, 97, 98\}$

b i $\frac{1}{20}$ ii $\frac{2}{5}$ iii $\frac{3}{4}$

5 a $\frac{1}{2}$ b $\frac{3}{4}$

6 40 320

7 56

8 70

9 a 120 b 60

10 $\frac{1}{120}$

11 a 12

12 a 360 b $\frac{1}{12}$ c 15 d $\frac{1}{15}$ e $\frac{1}{3}$

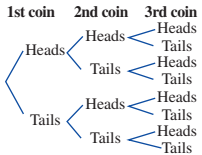
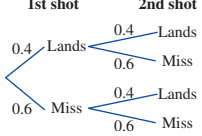
13 a $\frac{1}{1024}$ b $\frac{1}{1048576}$

14 a $\frac{3}{10}$ b $\frac{1}{10}$

15 $\frac{2}{5}$

- 16 a $\frac{8}{125}$ b $\frac{98}{125}$
 17 0.91
 18 $\frac{343}{512}$

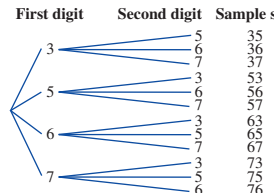
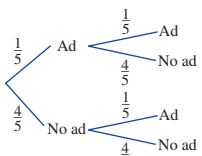
Extended response

- 1 a  b $\frac{3}{8}$ c $\frac{7}{8}$
 2 a  b i 0.16 ii 0.48 iii 0.64

CHAPTER 7

Applications of probability

Are you ready?

- 1 a $\frac{2}{3}$ b $\frac{1}{50}$ c $\frac{49}{99}$
 2 
 3 a  b $\frac{1}{25}$

Exercise 7A — Expected outcomes

- 1 20 2 50 3 25
 4 a 35 b 28 c 7
 5 1.25
 6 a 25 b 50 c 7.69
 d 30.77 e 1.92
 7 a $\frac{1}{25}$ b 2.08
 8 a 0.0144 b 48.9
 9 B 10 B 11 5
 12 a 90 b 90 c 30
 13

Outcome	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{5}{36}$	$\frac{1}{6}$	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$
Expected no.	2.8	5.6	8.3	11.1	13.9	16.7	13.9	11.1	8.3	5.6	2.8

- 14 a 55.26 b 60.53 c 39.47 d 94.74
 15 3.1
 16 a 14 b 4.9
 17 a 0.36 b 1.44

- 18 a 0.35 b 18.2
 19 a $\frac{1}{10\,000}$ b 10 000 20 375

Exercise 7B — Financial expectation

- 1 \$0.00 2 \$0.40 3 $-\$0.50$
 4 \$0.15 5 $-\$0.30$ 6 \$1.70
 7 a 37 b i 18 ii 18 iii 1
 c $-\$0.27$
 8 A 9 C 10 \$0.11 11 $-\$1.10$
 12 a The player can expect to have an average profit of 20c per game.
 b The player can expect to have an average loss of 20c per game.
 13 \$0.45
 14 $-\$2.50$
 15 \$1.60
 16 a i 0.72 ii -0.28
 b

Numbers selected	Prize	Probability of winning	Financial expectation
1	\$3	0.25	-0.25
2	\$12	0.06	-0.28
3	\$43	0.014	-0.40
4	\$112	0.00306	-0.66
5	\$610	0.000644	-0.61
6	\$1500	0.000129	-0.81

- c The one number game is the best value game.
 17 a \$40 979.31
 b

Numbers selected	Probability of winning	Minimum prize for a positive financial expectation
7	2.44×10^{-5}	\$40 979.31
8	4.35×10^{-6}	\$229 885.06
9	7.24×10^{-7}	\$1 381 215.47
10	1.12×10^{-7}	\$8 928 571.43

Exercise 7C — Two-way tables

	Test results		Total
	Accurate	Not accurate	
With virus	98	2	100
Without virus	388	12	400
Total	486	14	500

	Test results		Total
	Accurate	Not accurate	
Telling truth	777	23	800
Telling lies	156	44	200
Total	933	67	1000

- 3 a 1000 b 75 c 96.7% d $\frac{3}{5}$
 4 a 200 b 44 c 0.909
 d 0.051 e 94%
 f A range of factors should be considered, e.g. for an expensive system a 6% fail rate might be unsatisfactory.

5 B
 6 D
 7 A
 8 a

	Test results		Total
	Accurate	Not accurate	
Bags with prohibited items	48	2	50
Bags with no prohibited items	145	5	150
Total	193	7	200

- b i 96% ii 3.3% iii 4% iv 96.5%
 9 a

	Pure bred	Mixed bred	Total
Male	35	165	200
Female	45	155	200
Total	80	320	400

b $\frac{31}{80}$

10 a

	Positive	Negative	Total
Contains dangerous substance	99	1	100
Does not contain dangerous substances	16	384	400
Total	115	385	500

- b The machine needs to be 99% accurate.

11 a

	Smoker	Non-smoker	Total
Male	72	254	326
Female	43	131	174
Total	115	385	500

b $\frac{131}{500}$

c 13.04

12 a 2250

b 1500

13 a

	Positive	Negative	Total
With flu	12	2	14
Without flu	53	233	286
Total	65	235	300

- b The term *false positive* refers to a patient who tests positive to the flu but does not have the flu.

14 a $\frac{1}{200}$

- b Immunisation against measles should be recommended. The probability of getting measles if not immunised is $\frac{9}{20}$, which means there is a 90 times greater chance of contracting measles if not immunised.

Chapter review

Multiple choice

- 1 C 2 B 3 A

Short answer

- 1 18
 2 a 10 b 30 c 20
 3 a 50 b 25 c 7.69
 d 30.8 e 3.85
 4 a 2.5 b 15 c 7.5
 d 15 e 25
 5 a 12.5 b 37.5 c 50
 6 a 5 b 45 c 15
 7 \$0.00
 8 -\$0.60
 9 A positive financial expectation means that on average a profit should be made while a negative financial expectation means that on average a loss should be made.
 10 -\$0.03
 11 \$0.00
 12 \$0.30
 13 \$1.87

14

	Test results		Total
	Accurate	Not accurate	
With virus	48	2	50
Without virus	149	1	150
Total	197	3	200

15

	Test results		Total
	Accurate	Not accurate	
Telling truth	77	3	80
Telling lies	17	3	20
Total	94	6	100

- 16 a 140 b 30 c 90% d $\frac{1}{10}$
 17 a 130 b 33.85% c $\frac{39}{40}$

Extended response

- 1 a $\frac{1}{6}$ b 15 c $\frac{1}{18}$ d \$0.11
 2 a 200 b 96% c 34
 d $93\frac{1}{3}\%$ e $\frac{14}{15}$

CHAPTER 8

Annuities and loan repayments

Are you ready?

- 1 a $n = 5, r = 0.08$ b $n = 8, r = 0.03$
 c $n = 12, r = 0.019$ d $n = 120, r = 0.008$
 e $n = 30, r = 0.00066$

- 2 a \$5000 b \$7626 c \$5922
 3 a \$2292.19 b \$16 808.55 c \$18 499.35
 4 a \$8984 b \$15 750 c \$22 716

Exercise 8A — Future value of an annuity

- 1 \$7049.37
 2 a \$6691.13 b \$6859.14 c \$6158.56
 d \$3974.56 e \$17 713.21 f \$3530.21
 3 \$4472.93
 4 a i \$2217.44 ii \$2142.45
 iii \$2070 iv \$2000
 b \$10 429.89
 5 \$73 105.94
 6 a 22 b \$21 696.15 c \$283 057.94
 7 a \$25 155.79 b \$29 333.00 c \$433 046.81
 d \$217 372.57 e \$114 665.87
 8 a 5
 b No — she has saved \$29 041.96.
 c \$4041.96
 9 \$90 237.49
 10 a \$20 326.23 b \$24 297.37
 c \$45 881.32 d \$69 770.03
 11 A 12 C 13 \$4067.28
 14 a \$4524.37 b \$7068.59 c \$1930.08
 15 a \$56 160 b \$112 320 c \$242 106.74
 16 a \$5980.14 b \$558.24 c \$891.50
 17 a \$28 973.12 b \$29 778.08 c 2.8%
 18 a \$44 142.71 b \$48 096.95
 19 a \$26 988.85 b \$54 091.90
 c \$27 895.32 d \$81 987.22
 20 a \$398 298.15 b \$796 596.30
 21 a \$90.17 b \$1 945 292.64
 22 a \$5984.71 b \$914.63 c \$7181.65

Exercise 8B — Present value of an annuity

- 1 \$7537.11
 2 a \$12 418.43 b \$3786.09 c \$94 222.37
 3 \$48 987.91
 4 a \$37 685.57 b \$35 644.50
 c \$34 623.58 d \$33 943.00
 5 \$3511.79
 6 a \$11 257.78 b \$6116.69
 c \$14 783.59 d \$24 767.78
 7 \$22 851.87
 8 \$6113.60
 9 A 10 D
 11 Investment A
 12 C
 13 a \$15 864.53
 b Yes, Kylie will have \$32 547.59.
 14 a \$58 249.66 b \$56 407.36
 c A lesser amount of money needs to be invested to achieve the same financial outcome.
 d 3.2%
 15 a \$21 908.51 b \$22 228.99 c 1.46%
 16 Andrew's present value is \$6710.08. John's is \$6144.57, which is only 8.4% less, so John is incorrect.
 17 a \$49 151.18 b \$13 272.21
 18 a \$176 272.10 b \$21 894.75 c \$22 098.20
 19 \$7086.00

Exercise 8C — Future and present value tables

- 1 \$4787.76
 2 a \$1324.00 b \$23 932.35
 c \$7503.81 d \$62 953.50
 3 a 4% b 10 c \$6003.05
 4 a \$4103.92 b \$5335.38 c \$7546.74

- 5 5% for 6 years. \$1 will grow to \$6.8019 but at 6% for 5 years it will grow to \$5.6371.

- 6 D
 7 \$6918.50
 8 a \$1845.09 b \$12 289.20
 c \$4455.79 d \$16 604.40
 9 a \$192 428.13 b \$331 070.40
 c \$737 277.43 d \$213 778.90
 10 a \$289 570.55 b \$717 465.20
 c \$233 356.13 d \$32 244.88
 11 a \$307 598.63 b \$6680
 12 a \$34.93 b \$52 395 c \$17 955
 13 a \$34 916.58 b \$23 520.09
 14 a \$60 694.34 b \$610.83 c \$1156.57

Exercise 8D — Loan repayments

- 1 \$2637.97
 2 \$210.67
 3 a \$94.15 b \$311.38 c \$859.72
 d \$484.17 e \$1511.14
 4 \$1397.37
 5 a \$375 b \$3375 c \$107.32
 6 \$374.53
 7 a \$28 000 b \$138.21
 8 \$16 847.35
 9 a \$4359.36 b \$29 059.20
 c \$98 285.40 d \$366 700.80
 10 D
 11 B
 12 9 years, 3 months
 13 a \$1320.99 b \$396 297.00
 c 14 years, 6 months d \$117 897
 14 a \$532.90 b \$557.32
 c \$608.04 d \$688.66
 15 a \$1799.45 b \$1916.10
 16 8%
 17 a 2528.87
 b Interest = \$1898.75, principal = \$630.12
 18 a \$9082.72 b \$544 963.28
 c \$192 963.28
 d It would cost \$2045.42 less if repayments were made monthly.
 19 Paying monthly with total repayments of \$22 016.40 is the cheapest way to repay the loan.

Chapter review

Multiple choice

- 1 D 2 B 3 B 4 D

Short answer

- 1 a \$4917.25 b \$2960.49
 c \$31 053.57 d \$5461.06
 2 \$16 398.20
 3 a \$66 666.94 b \$31 371.42
 c \$14 291.59 d \$247 313.84
 4 \$36 604.24 5 \$3088.13
 6 a \$3793.40 b \$468.93 c \$217.69
 7 \$20 057.99
 8 a \$6139.13 b \$4298.72
 c \$3219.64 d \$36 945.53
 9 \$11 654.84
 10 \$5113.34
 11 a \$524 573.59 b \$13 002.83
 12 \$41 039.20
 13 a \$4399.95 b \$34 641.25
 c \$1842.84 d \$51 014.25

- 14 \$2242.95
 15 a \$1516.32 b \$14 047.20
 c \$4055.45 d \$11 177.64
 16 \$547.41
 17 a \$553.76
 b \$26 580.48
 18 \$503 055
 19 a \$226.10
 b \$5426.40
 c \$1026.40

Extended response

- 1 a \$91 523.93 b \$19 636.30 c \$5362.05
 2 a \$63 792.85 b \$2384.89 c \$67 443.86
 3 a \$1651.63 b \$246 391.20 c \$112 692.48

CHAPTER 9

Modelling linear and non-linear relationships

Are you ready?

1 a

x	-3	-2	-1	0	1	2	3
y	-6	-4	-2	0	2	4	6

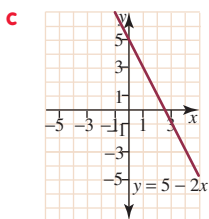
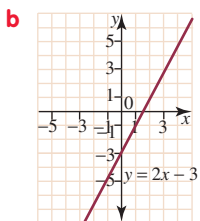
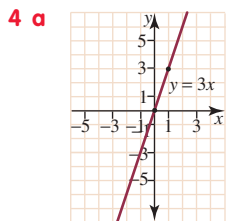
b

x	-3	-2	-1	0	1	2	3
y	-10	-7	-4	-1	2	5	8

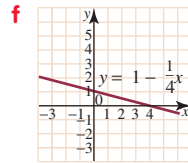
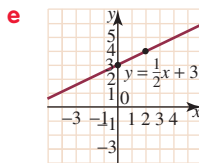
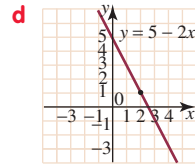
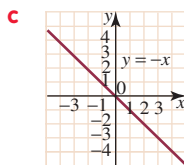
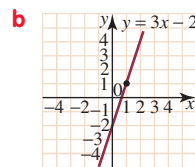
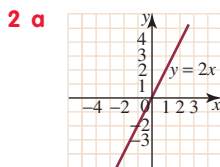
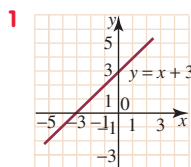
c

x	-3	-2	-1	0	1	2	3
y	16	13	10	7	4	1	-2

- 2 a Linear b Not linear c Not linear
 d Linear e Not linear f Linear
 3 a $\frac{5}{4}$ b -3 c -2

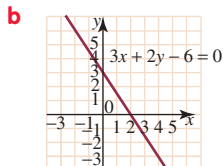


Exercise 9A — Linear functions



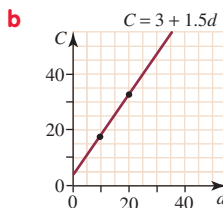
3 a

x	0	2	4
y	3	0	-3

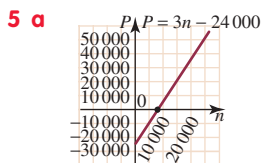


4 a

d	0	5	10	30
C	3	10.5	18	48



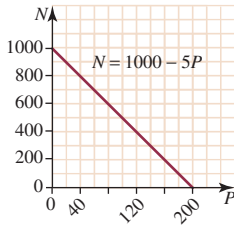
- c \$33 d 14 km



n	0	8000	10 000
P	-24 000	0	6000

- b \$36 000 c \$9000 loss d 8000 people

6 a



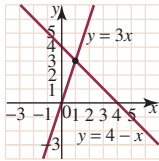
b 500

c \$1.80

14 a

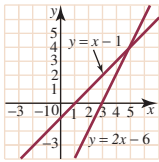
Number of plans sold	Salary package A	Salary package B
5	\$525	\$375
10	\$650	\$600
15	\$775	\$825
20	\$900	\$1050

7 a



b (1, 3)

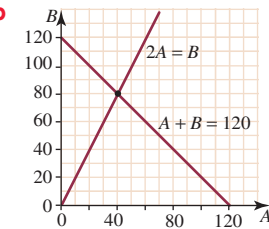
8



Intersection (5, 4)

9 (0, 2)

10 a, b

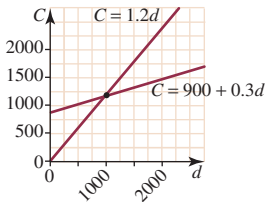


c Game A: 40; Game B: 80.

11 a

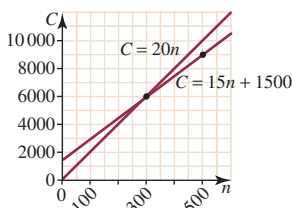
d	0	1000	2000
C (old)	0	1200	2400
C (new)	900	1200	1500

b



c After 1000 days

12 a

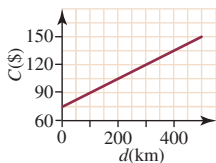


b 300

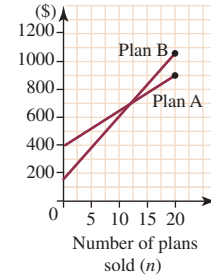
13 a \$114.75

b 450 km

c



b



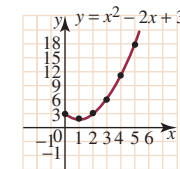
c 13

Exercise 9B — Quadratic functions

1 a

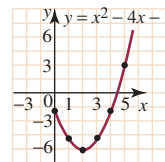
x	0	1	2	3	4	5
y	3	2	3	6	11	18

b

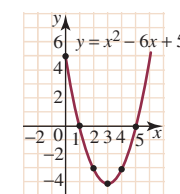


c Min. value = 2

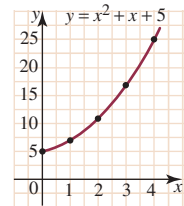
2



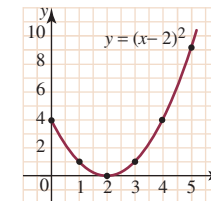
3 a



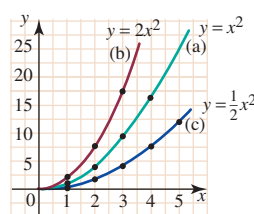
b

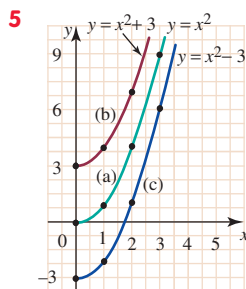


c

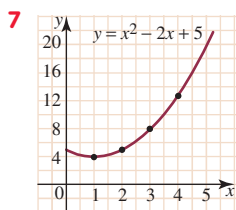


4

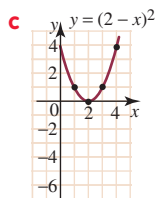
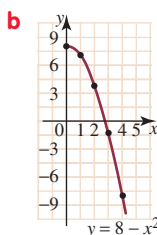
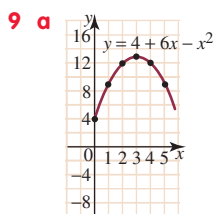
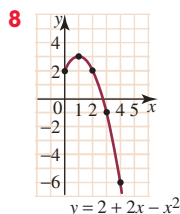




- 6 a The coefficient will make the graph steeper if it is greater than 1 and flatten the graph if it lies between 0 and 1.
 b Adding a constant will lift the graph while subtracting a constant will lower the graph.



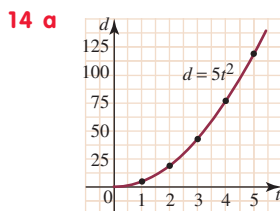
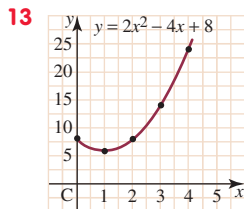
They are the same function.



10 D

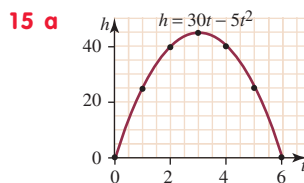
11 C

12 D



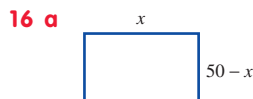
b 80 m

c 10 s



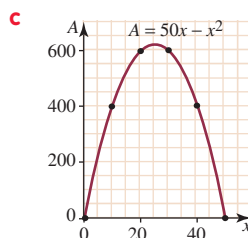
b 45 m

c 6 s



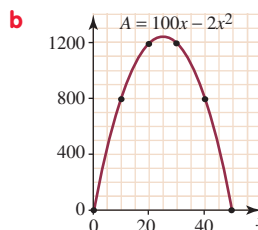
Sum of adjacent sides = 50 m

b $A = l \times b$
 $= x(50 - x)$
 $= 50x - x^2$



d 625 m² when the field is 25 m × 25 m

17 a $A = l \times b$
 $= x(100 - 2x)$
 $= 100x - 2x^2$



c 25 m × 50 m

18 a Narrower, TP (0, 0)

c Narrower, TP (0, 0)

e Wider, TP (0, 0)

g Narrower, TP (0, 0)

19 a Narrower, minimum

c Wider, minimum

e Narrower, maximum

g Narrower, minimum

i Narrower, minimum

k Narrower, minimum

b Wider, (0, 0)

d Narrower, TP (0, 0)

f Wider, TP (0, 0)

h Narrower, TP (0, 0)

b Narrower, maximum

d Wider, maximum

f Wider, minimum

h Wider, maximum

j Narrower, maximum

l Narrower, maximum

20 20 h

21 a 200

b

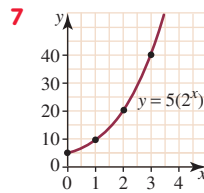
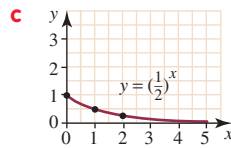
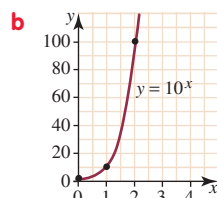
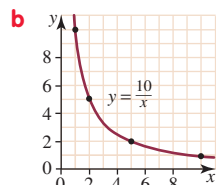
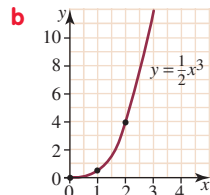
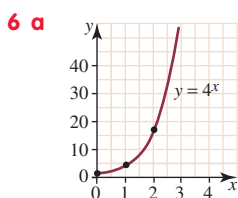
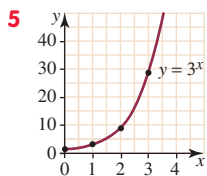
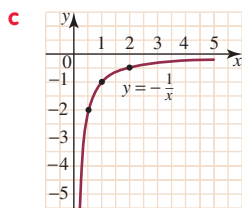
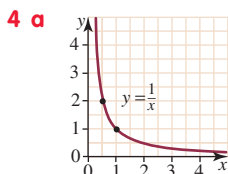
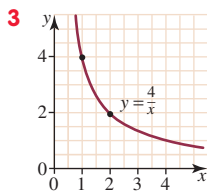
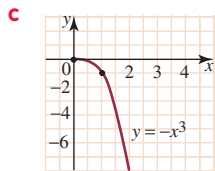
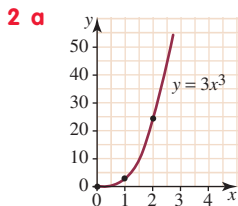
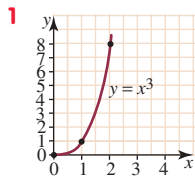
h	0	5	10	15	20	30	50
N	200	201	199	193	183	153	46

c 56.4 h

22 a 1 m

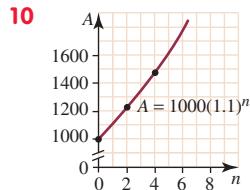
b 0.4375 m

Exercise 9C — Other functions

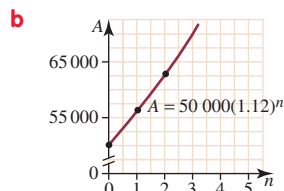


8 C

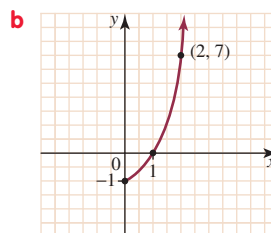
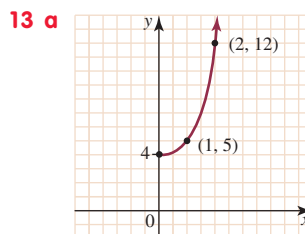
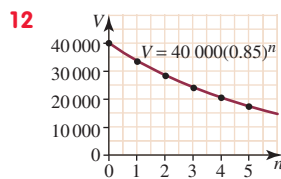
9 B

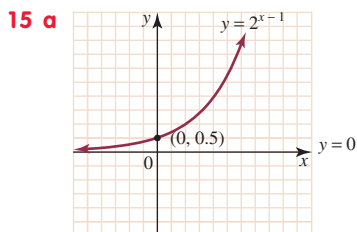
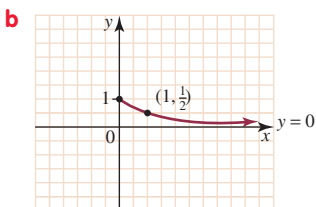
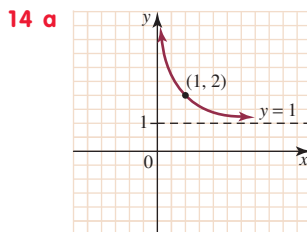
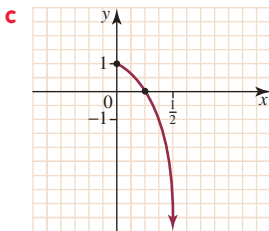


11 a $A = 50\,000(1.12)^n$

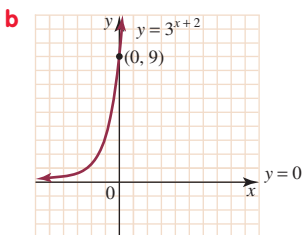


c 3 years

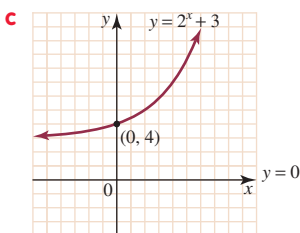




Asymptote: $y = 0$; y-intercept: $(0, 0.5)$; domain: $(-\infty, \infty)$; range: $(0, \infty)$



Asymptote: $y = 0$; y-intercept: $(0, 9)$; domain: $(-\infty, \infty)$; range: $(0, \infty)$



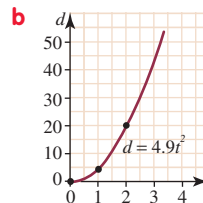
Asymptote: $y = 0$; y-intercept: $(0, 4)$; domain: $(-\infty, \infty)$; range: $(0, \infty)$

Exercise 9D — Variations

1 $y = 5.5x^2$

2 $b = 0.5a^3$

3 a $d = 4.9t^2$



4 a 6

5 a 3.14

6 a 0.25

7 a i 148.8 cm

8 a 570.15 L

b The Nissan Pulsar as it uses less petrol to cover 100 km.

9 a 1818 m²

10 a i 12

11 a $h = \frac{10w}{7}$

12 40

13 a 624 km

c 47 h 30 min

14 a 4WD = 81.9 L, Small car = 38.4 L

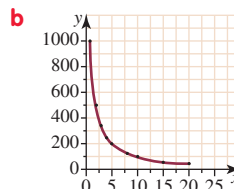
b 2132 km

15 a 48 L/100 km

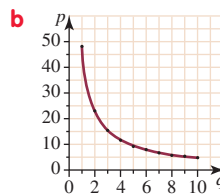
b 2920 km

Exercise 9E — Inverse variation

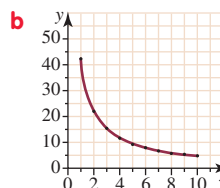
1 a $k = 1000$, $x = \frac{1000}{y}$ or $y = \frac{1000}{x}$



2 a $k = 48$, $p = \frac{48}{q}$



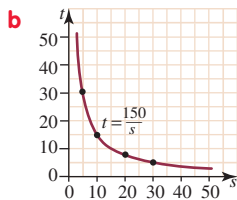
3 a $k = 42$, $y = \frac{42}{x}$



4 $y = \frac{50}{x}$

5 $m = \frac{1}{n}$

6 a $t = \frac{150}{s}$



7 a 20

b 2 hours

8 12 km/L or $8\frac{1}{3}$ L/100 km

9 8 amps

b $a = \frac{4000}{m}$

10 a 4000

c 20 m/s²

d 4 m/s²

11 a $n = \frac{500}{c}$

b 2500

c 2000

12 a 337.5

b 3 h 58 min

c 96.42 km/h

d 337.5 km

13 a 17 500

b \$233.33

c 70

d \$17 500

14 a 200

b 1 amp

c 13.3 ohms

15 a 200

b 2 min

c 600 mHz

16 a 10 500

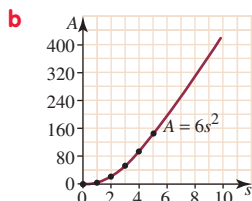
b 210 days

c 105

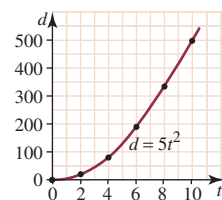
Exercise 9F — Graphing physical phenomena

1 a

s	0	1	2	3	4	5
A	0	6	24	54	96	150

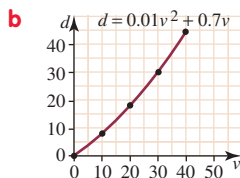


2

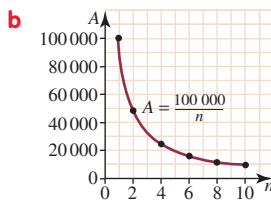


3 a

v	0	10	20	30	40
d	0	8	18	30	44



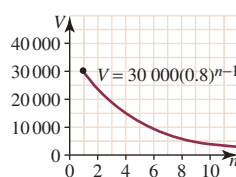
4 a $A = \frac{100\,000}{n}$



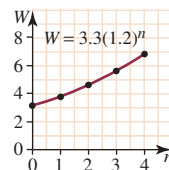
5 a

Age (years)	1	2	3	4	5
Value	\$30 000	\$24 000	\$19 200	\$15 360	\$12 288

b



6

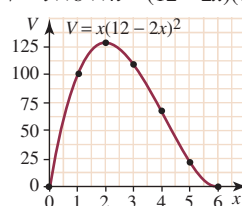


7 a

Just less than 6

b $V = l \times b \times h = (12 - 2x)(12 - 2x)x = x(12 - 2x)^2$

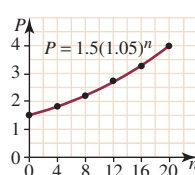
c



8 a

Year	2007	2008	2009	2010	2011	2020	2027
Population (million)	1.5	1.58	1.65	1.74	1.82	2.83	3.98

b



c 2027

d The graph will become a straight, horizontal line.

9 $k = 3$

10 $d = 0.008\,33s^2$

11 $I = \frac{30000}{R}$

12 a $y = ax^3, a = 0.3$

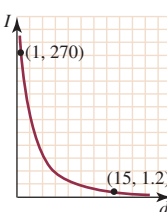
b $y = ax^2, a = -6$

c $y = a\sqrt{x}, a = 1.6$

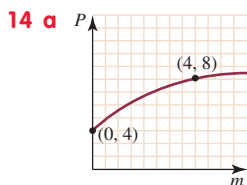
d $y = \frac{a}{x}, a = 5$

e $y = ax^3, a = -1.5$

13 a

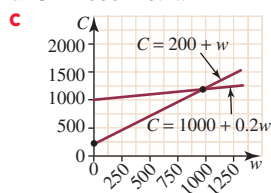


b $I = \frac{270}{d^2}$



b $p = 2\sqrt{m} + 4$
 c $m = 11$,
 $p = 2\sqrt{11} + 4$
 $= 10.63$
 $m = 12$,
 $p = 2\sqrt{12} + 4$
 $= 10.93$

5 a $C = 1000 + 0.2w$



b $C = 200 + w$
 d 1000 washes

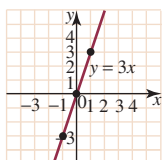
Chapter review

Multiple choice

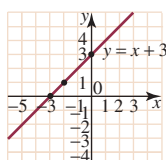
1 B 2 D

Short answer

1 a



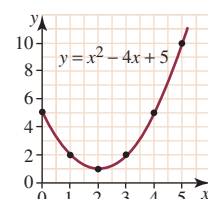
b



6 a

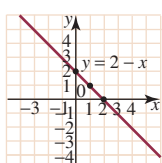
x	0	1	2	3	4	5
y	5	2	1	2	5	10

b

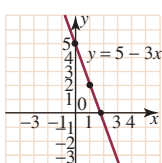


c 1

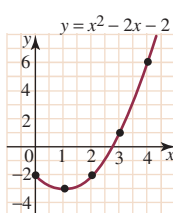
c



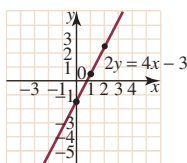
d



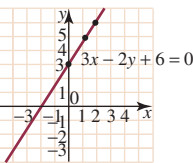
7



e



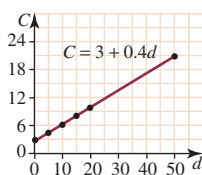
f



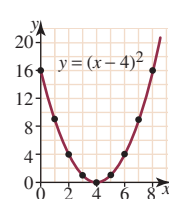
2 a

d	0	5	10	15	20
D	3	5	7	9	11

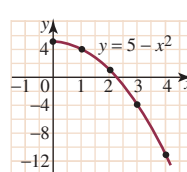
b



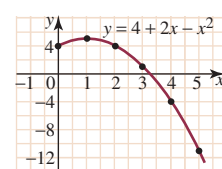
8 a



b

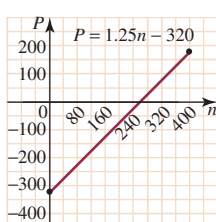


c

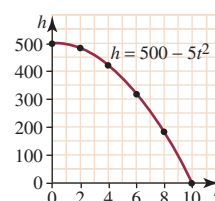


3 a $P = 1.25n - 320$

b



9 a



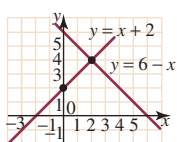
b 10 s

c i \$55 profit

ii \$142.50 loss

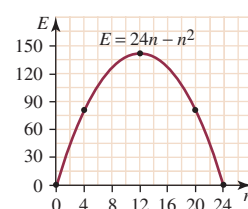
d 256

4



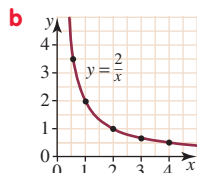
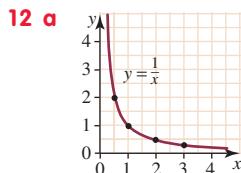
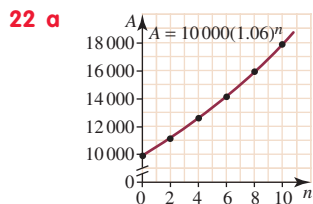
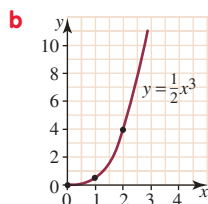
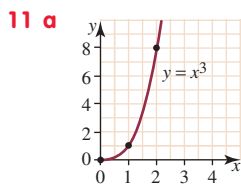
Intersection (2, 4)

10 a



b 144 kg, 12 workers

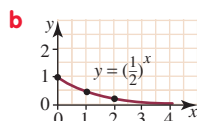
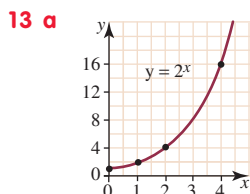
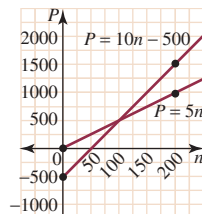
c Too many people getting in each other's way etc.



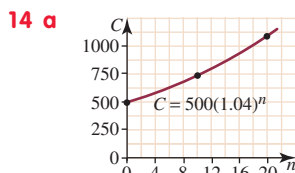
b \$16000
c 7 years

Extended response

1 a $P = 10n - 500$ **b, d**



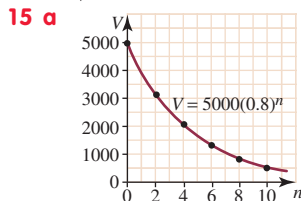
c 50
e More than 100 people



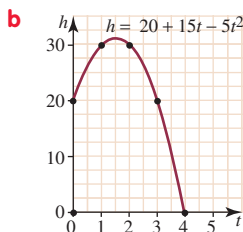
2 a

t	0	1	2	3	4
h	20	30	30	20	0

b \$740 **c** 2024



b 7 years



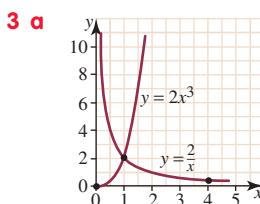
Max. height = 31.25 m when $t = 1.5$

16 $y = 5x^2$

17 a $m = 0.45l^3$ **b** 56.25 g **c** 4.8 cm

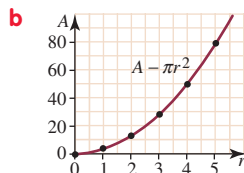
18 $y = \frac{64}{x}$

19 a $A = \frac{1000}{n}$ **b** 8 days **c** 250 campers

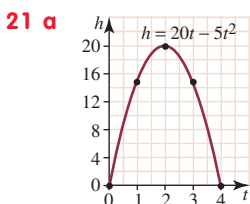
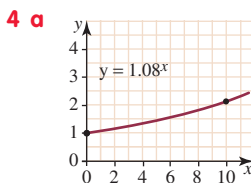


20 a

r	0	1	2	3	4	5
A	0	3.14	12.57	28.27	50.27	78.54

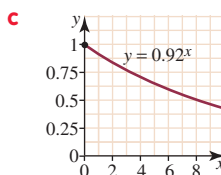


b (1, 2)



b i 20 m **ii** 4 s

b 10 years



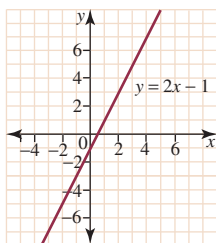
d 8 years

CHAPTER 10

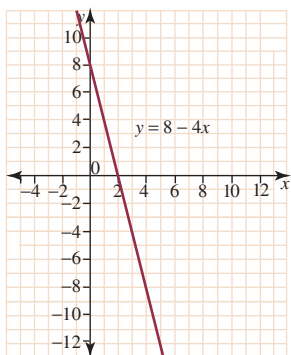
Depreciation

Are you ready?

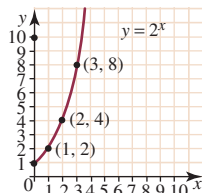
1 a



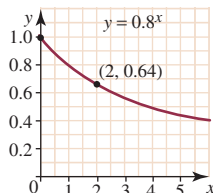
b



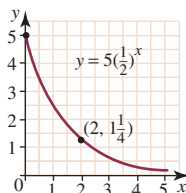
2 a



b



c



3 a $x = 12$

b $x = 4\frac{1}{3}$

c $x = 5$

4 a \$13 382.26

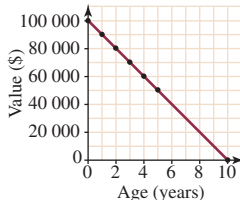
b \$68 956.60

5 a \$13 110

b \$63 100

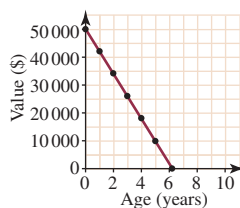
Exercise 10A — Modelling depreciation

1 a



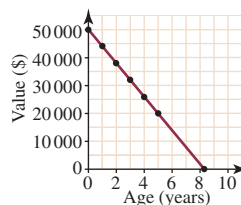
b $V = 100\,000 - 10\,000A$

2



$$V = 50\,000 - 8000A$$

3 a

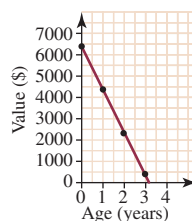


b \$20 000

c 8.33 years. In the 9th year.

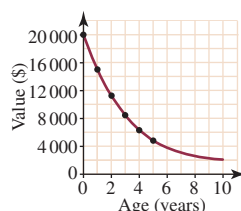
4 a $V = 6400 - 2000A$

b



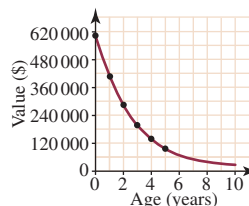
c 3.2 years. In the 4th year.

5 a



b \$2000

6 a



b \$17 000

c 7

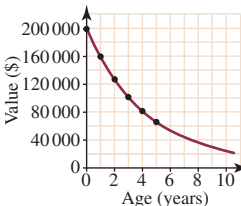
7 a i \$160 000

ii \$128 000

iii \$102 400

iv \$81 920

b



8 B

9 a

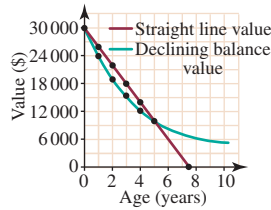
Age (years)	Value (\$)
New (0)	30 000
1	26 000
2	22 000
3	18 000
4	14 000
5	10 000

b See part d

c

Age (years)	Value (\$)
New (0)	30 000
1	24 000
2	19 200
3	15 360
4	12 228
5	9830

d



e After 5 years or in the 6th year.

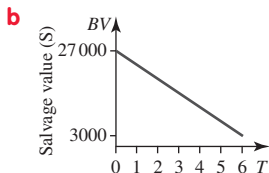
- 10 a i \$3000 ii \$500 iii 6 years
 b i \$3500 ii \$1000 iii $3\frac{1}{2}$ years
 c i \$4000 ii \$700 iii 6 years
 d i \$18 000 ii \$2400 iii $7\frac{1}{2}$ years

11 D 12 A 13 B

- 14 a Computer B b 2 years
 15 \$7600

Exercise 10B — Straight line depreciation

- 1 \$20 000
 2 a \$1000 b \$10 300 c \$270 000
 d \$145 e \$32 000
 3 a \$7 125 000 b \$3 750 000
 4 \$10 600
 5 8 years
 6 a 6 years b 5 years
 c 8 years d 7 years
 7 \$2500/year
 8 a \$4000/year b \$12 500/year c \$14 500/year
 9 \$900/year
 10 \$25 000
 11 a \$110 000 b \$26 500 c \$1450
 12 \$78 000
 13 a \$3000



- 14 a \$6200 b $S = 31\,000 - 6200n$ c 4 years
 15 a \$10 350 b $S = 69\,000 - 10\,350n$ c 6 years
 16 a \$1020 b $S = 6000 - 1020n$ c 5.88 years
 17 a i \$5000 per year ii 8 years
 b i \$200 per year ii $8\frac{1}{2}$ years
 c i \$133 per year ii 13 years
 d i \$25 343.75 per year ii 12 years
 18 a \$54 000 b \$2160 c \$36 720

Exercise 10C — Declining balance method of depreciation

- 1 \$20 480
 2 a \$2220 b i \$750 ii \$390
 3 7 years
 4 \$383 000
 5 a \$5900 b \$68 100 c \$1200
 d \$62 100 e \$3900
 6 \$6174
 7 \$676 000
 8 a \$14 600 b \$20 400
 9 A 10 C
 11 a \$5360 b \$2640
 c \$3591 d \$1769
 12 5 years
 13 a $S = 90\,000(0.8)^n$

Time (years)	Depreciation (\$)	Value (\$)
0	—	90 000
1	18 000	72 000
2	14 400	57 600
3	11 520	46 080
4	9216	36 864

c \$23 592.96

14 a

Time (years)	Depreciation (\$)	Value (\$)
0	—	6000
1	2400	3600
2	1440	2160
3	864	1296
4	518.40	777.60

b \$466.56 c 8 years

15

Time (years)	Depreciation (\$)	Value (\$)
0	—	4500
1	1800	2700
2	1080	1620
3	648	972
4	388.80	583.20

16 a

Time (years)	Depreciation (\$)	Value (\$)
0	—	2000
1	500	1500
2	375	1125
3	281.25	843.75
4	210.94	632.81

b 6 years

17 a

Flat rate			Reducing balance		
Time (years)	Depreciation (\$)	Value (\$)	Time (years)	Depreciation (\$)	Value (\$)
0	—	1650	0	—	1650
1	330	1320	1	495	1155
2	330	990	2	346.50	808.50
3	330	660	3	242.55	565.95
4	330	330	4	169.79	396.17
5	330	0	5	118.85	277.32

b 4 years

18 a

Flat rate			Reducing balance		
Time (years)	Depreciation (\$)	Value (\$)	Time (years)	Depreciation (\$)	Value (\$)
0	—	60 000	0	—	60 000
1	20 000	40 000	1	30 000	30 000
2	20 000	20 000	2	15 000	15 000
3	20 000	0	3	7500	7500

b 3 years

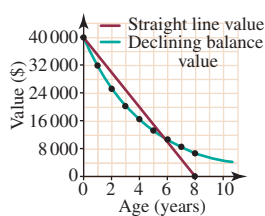
Exercise 10D — Depreciation tables

1 a \$1683.50 **b** \$9537.50 **c** \$34 870

2 a

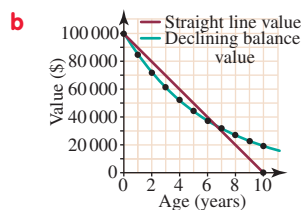
Age of car (years)	Straight line value (\$)	Declining balance value (\$)
New (0)	40 000	40 000
1	35 000	32 000
2	30 000	25 600
3	25 000	20 480
4	20 000	16 384
5	15 000	13 100
6	10 000	10 500
7	5000	8400
8	0	6700

b **c** After 6 years



3 a

Age of car equipment (years)	Straight line value (\$)	Declining balance value (\$)
New (0)	100 000	100 000
1	90 000	85 000
2	80 000	72 250
3	70 000	61 400
4	60 000	52 200
5	50 000	44 350
6	40 000	37 700
7	30 000	32 050
8	20 000	27 250
9	10 000	23 150
10	0	19 700



4

Age of computer (years)	Salvage value at 20% (\$)	Salvage value at 35% (\$)
0	4400.00	4400.00
1	3520.00	2860.00
2	2816.00	1859.00
3	2252.80	1208.35
4	1802.24	785.43
5	1441.79	510.53
6	1153.43	331.85

5

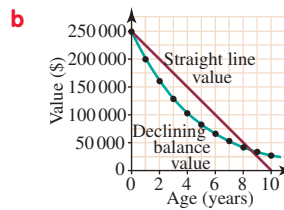
Years	Salvage value (\$)	Tax deduction (\$)
1	4355	2145
2	2918	1437
3	1955	963
4	1310	645
5	878	432
6	0	878

6

Years	Salvage value (\$)	Tax deduction (\$)
1	33 750	11 250
2	25 313	8437
3	18 985	6328
4	14 239	4746
5	10 679	3560
6	8009	2670
7	6007	2002
8	4505	1502

7 a

Age of truck (years)	Straight line value (\$)	Declining balance value (\$)
New (0)	250 000	250 000
1	225 000	200 000
2	200 000	160 000
3	175 000	128 000
4	150 000	102 400
5	125 000	81 920
6	100 000	65 536
7	75 000	52 429
8	50 000	41 943
9	25 000	33 554
10	0	26 844



c

Age of truck (years)	Salvage value — straight line (\$)	Tax deduction (\$)
1	225 000	25 000
2	200 000	25 000
3	175 000	25 000
4	150 000	25 000
5	125 000	25 000
6	100 000	25 000
7	75 000	25 000
8	50 000	25 000
9	25 000	25 000
10	0	25 000

Age of truck (years)	Salvage value — declining balance (\$)	Tax deduction (\$)
1	200 000	50 000
2	160 000	40 000
3	128 000	32 000
4	102 400	25 600
5	81 920	20 480
6	65 536	16 384
7	52 429	13 107
8	41 943	10 486
9	33 554	8389
10	26 844	6711

- 8 a** \$10 000 **b** $\frac{1}{3}$ **c** \$3333.33
9 a \$3000 **b** \$75 **c** \$1600 **d** \$750
10 a \$3145.50 **b** 13 years
11 a \$152 600 **b** 15 years
12 a 7 years **b** 4 years **c** 3 years
13 a 16 years **b** 10 years **c** 6 years **d** 4 years
14 a 0.3857 **b** \$3278.45 **c** \$5221.55
15 a \$36 000 **b** \$78 400 **c** 10 years

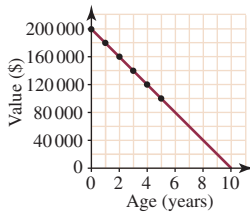
Chapter review

Multiple choice

- 1 A 2 C 3 A 4 C

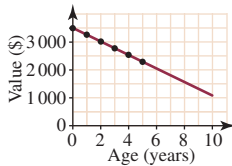
Short answer

1 a



b $V = 200\,000 - 20\,000A$

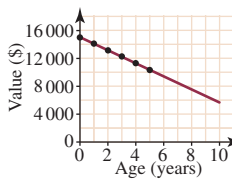
2 a



b $V = 3\,500 - 250A$

c \$1250

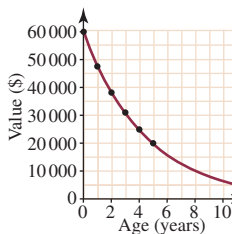
3 a



b \$10 500

c 17 years

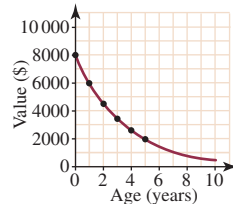
4 a



b \$6500

c 9 years

5



6 \$6500

7 a \$1300

b \$15 000

c \$235 000

8 12 years

9 \$250/year

10 After 6 years

11 \$20 880

12 \$474 000

13 a \$23 620

b \$1000

c \$24 290

d \$27 210

e \$49 380

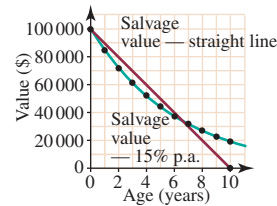
14 a \$167 100

b \$432 900

15 a

Age (years)	Salvage value — straight line (\$)	Salvage value — 15% p.a. (\$)
New (0)	100 000	100 000
1	90 000	85 000
2	80 000	72 250
3	70 000	61 912.50
4	60 000	52 200.65
5	50 000	44 370.53
6	40 000	37 714.95
7	30 000	32 057.71
8	20 000	27 249.05
9	10 000	23 161.69
10	0	19 687.44

b



16

Year	Salvage value (\$)	Tax deduction (\$)
1	3015	1485
2	2020	995
3	1353	667
4	907	446
5	0	907

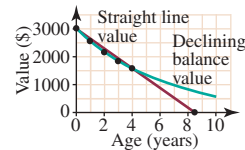
Extended response

1 a \$1566

b \$1434

c \$358.50/year

d



2 a \$24 000

b

Year	Salvage value (\$)	Tax deduction (\$)
1	176 000	24 000
2	154 880	21 120
3	136 294.00	18 585.60
4	119 939.07	16 355.33
5	105 546.38	16 392.69

c 11 years

The normal distribution

Are you ready?

- 1 a 5.75 b 65.7 c 8.1 d 17.032
2 a 2.4 b 17.3 c 1.1 d 1.3
3 a Sample b Population

Exercise 11A — z-scores

- 1 3 2 -2
3 a 2 b -2 c -1.03 d 2.95
4 a 0 b 1 c -2
d 3 e -1
5 a 10.5 b 13.7 c 16.9
d 7.3 e 0.9
6 -0.27
7 1.5
8 a -0.48 b 1.44 c 0.08
d -2.24 e 2.8
9 a 10.3 s b 10.58 s c 10.37 s
d 9.88 s e 10.251 s f 10.524 s
10 a One standard deviation above the mean
b Two standard deviations below the mean
11 a $\bar{x} = 19.55$, $s_n = 1.76$ b 1.68

12 a

Amount (\$)	Class centre	Frequency
0–20	\$10	2
20–40	\$30	8
40–60	\$50	19
60–80	\$70	15
80–100	\$90	6

- b $\bar{x} = 56$, $\sigma_n = 20.1$
c i -0.30 ii 2.2 iii -2.0
13 a 50 b 8
14 B 15 B 16 C
17 a $\bar{x} = 64.7$, $\sigma_n = 11.4$
b Highest score $z = 2.66$, Lowest score $z = -1.73$
18 English 1, Maths 1.31, Biology 1.5, Computing studies -2, Visual arts 0.67, Music -0.8
19 Male: 13 min 12 s; female: 14 min 15 s
20 a True. Each score is measured by how many standard deviations above or below the mean it is. Therefore, the z-score of the mean must be 0.
b True. A person performing one standard deviation better than the mean could have a z-score of -1 if a lower value is better, e.g. the time taken to run a race. But a person performing one standard deviation better than the mean would have a z-score of 1 if a higher score is better, e.g. the marks achieved on a Maths test.
21 a $\bar{x} = 40.2$, $\sigma_n = 16.0$
b -1.075, 0.3, -0.5125, 1.8625, 0.2375, 0.55, -1.1375, -0.2625, -1.2625
c Mean of the scores = 0, standard deviation = 1
d This is the mean and standard deviation of any set of standardised scores.
22 a $\bar{x} = \$642.70$, $\sigma_{n-1} = 436.9$
b \$1754 and \$86
c \$1754 is a z-score of 2.54; \$86 is a z-score of -1.27
23 a -1 b 2.5 c 0 d -3.5
24 Barney's height corresponds to a z-score of -1.07, and Fred's height corresponds to a z-score of 1.55. It can be said that Fred is taller than Barney is short.

Exercise 11B — Comparison of scores

- 1 a English 1.25, Maths 1.33
b Maths mark is better as it has a higher z-score.
2 2nd test, Barbara's z-score was -0.33 compared to -0.5 in the first test.
3 B
4 D
5 Course A, z-score of -0.8 compared to -0.75 on course B
6 a Sydney 0.44, Athens 1
b In Sydney because of the lower z-score
7 C
8 B
9 a Maths $\bar{x} = 59.5$, $s_n = 17.9$
Chemistry $\bar{x} = 59.6$, $s_n = 16.8$
b Maths 0.25, Chemistry 0.20. Maths is the better result.
10 Kory is the better candidate with a z-score of 1.5 compared with 0.875 for Ricardo.
11 a English 1.25, Maths 1.4
b Maths
12 Eamon's z-score = -2; Stephanie's z-score = -1.5. Eamon's performance is better as he is more below the mean than Stephanie.
13 Milk z-score = 2.5, Bread z-score = 2.4. The milk is relatively more expensive.
14 a -2.33
b The number of visitors was extremely low.
c Possible causes include weather, the economy, airline schedules etc.
15 a 656.25 b 2552
16 The machine must be closed for further testing. One bottle (1486 mL, $z = -1.75$) has a z-score less than -1.5.
17 In London $z = 2$. In Sydney $z = -1.78$. It is relatively warmer in London compared to the average there than it is cooler in Sydney relative to the average there.

Exercise 11C — Distribution of scores

- 1 a 68% b 95% c 99.7%
2 a 68% b 95% c 99.7%
3 95%
4 16%
5 a 68% b 16% c 0.15%
6 21.1 and 33.9
7 a 68% of the values have a z-score between -1 and 1.
b 95% of the values have a z-score between -2 and 2.
c 99.7% of the values have a z-score between -3 and 3.
8 B
9 A
10 0.15%
11 a 16% b 16%
12 a 95% b 16% c 34%
d 15.85% e 83.85%
13 a 95 g to 105 g
b 92.5 g to 107.5 g
14 163 cm - 181 cm
15 Faulty, as the one chosen has a z-score greater than 3
16 2.6 kg - 5 kg
17 a 5.85 N and 6.15 N
b 5.7 N and 6.3 N
c 5.55 N and 6.45 N
18 B
19 a 84% b 0.15% c 97.5% d 97.35%
20 a 16% b 0.15% c 97.5% d 81.5%
21 a 200 b 336 c 64 d 10
22 462

Chapter review

Multiple choice

- 1 B 2 B 3 B
4 D 5 B 6 C

Short answer

- 1 -2
2 a 0 b 1 c -2
d 3 e -1
3 1.87
4 a 0.17 b 1.83 c -3
d -1.75 e -2
5 a $\bar{x} = 20.1$, $\sigma_n = 2.1$
b Highest = 1.91, Lowest = -1.98
6 a $\bar{x} = 1130$, $\sigma_n = 334.2$
b i -0.39 ii 2.05 iii -2.62 iv -1.13 v 3.07
7 a 1.5 b 1
c Physics, higher z-score
8 a Geography: -0.8, Business studies: -0.53
b Business studies: higher z-score
9 Numeracy: lower z-score
10 a 68% b 95% c 99.7%
11 a 68% b 95% c 99.7%
12 a 34% b 47.5% c 2.5%
d 0.15% e 97.35%
13 Faulty, as it is more than three standard deviations from the mean.

Extended response

- 1 a Physics $\bar{x} = 65.1$, $s_n = 5.9$
Chemistry $\bar{x} = 62.4$, $s_n = 11.8$
b Physics -0.02, Chemistry 0.39
c Chemistry has a higher z-score.
d 53.3 and 76.9
e 27 and 97.8
2 a -2
b Faulty, more than two standard deviations from the mean

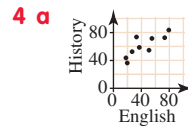
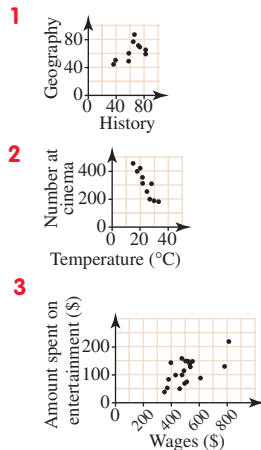
CHAPTER 12

Correlation

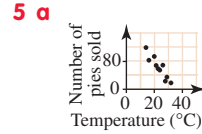
Are you ready?

- 1 a 4 b 15
2 a $y = 198$ b $x = 52$
3 a 3 b $\frac{1}{4}$
4 a 6, positive b $-1\frac{1}{2}$, negative

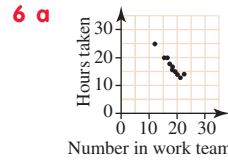
Exercise 12A — Scatterplots



- b The greater the English mark, the greater the History mark generally is. However, as the points on the scatterplot do not form a straight line, the relationship is not linear.



- b The greater the temperature, the fewer pies are sold. The points on the scatterplot approximate a straight line and so the relationship can be said to be linear.



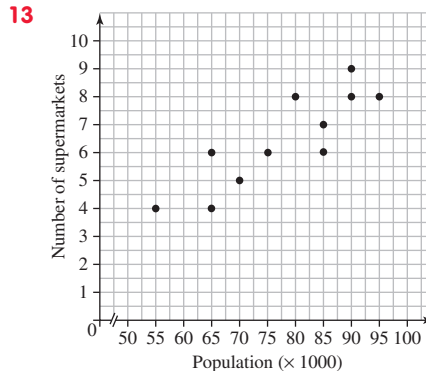
- b The more workers on the team reduces the amount of time taken to unload the ship, and, as the points on the scatterplot form a straight line, the relationship is linear.

7 D

8 A

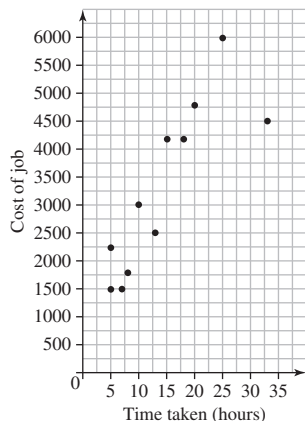
- 9 a The scatterplot shows a relationship between 2 quantities. As one increases, the other generally increases.
b The scatterplot shows a relationship between 2 quantities. As one increases, the other generally decreases.
10 a Positive relationship
b Positive relationship
c Positive relationship
d No relationship
e Positive relationship.
11 a Positive linear relationship
b Positive linear relationship
c Negative linear relationship
d Negative linear relationship
e No relationship
f Negative non-linear relationship

12 C



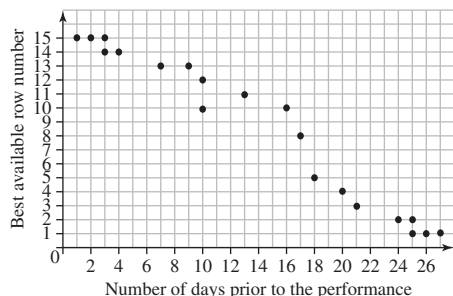
There is a positive linear relationship.

14 a



b There is a positive linear relationship.

15 a

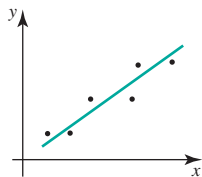


b There is a negative linear relationship.

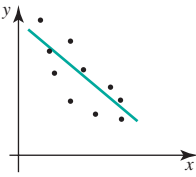
Exercise 12B — Fitting a straight line by eye

(Note: Best fit lines are indicated as a guide only.)

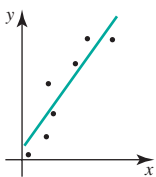
1 a



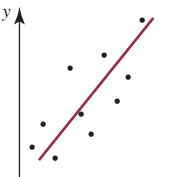
b



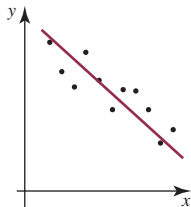
c



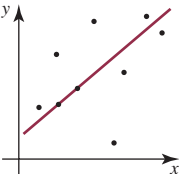
d



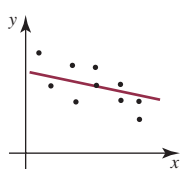
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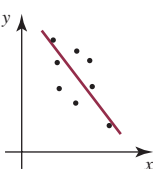
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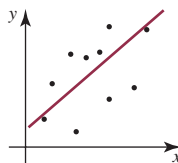
g



h



i

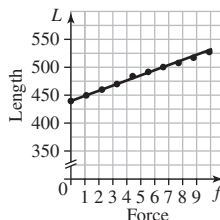


2 a $m = 5, b = 12$

b $m = -0.4, b = 70$

c $m = 100, b = 750$

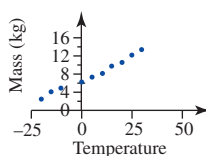
3 a



b $L = 10f + 440$

c The vertical intercept is the length of the elastic with no force, and the gradient is the amount by which the elastic is stretched by each extra unit of force.

4 a

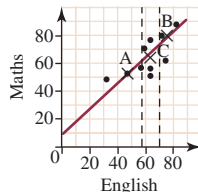


b $M = 0.2t + 6.5$

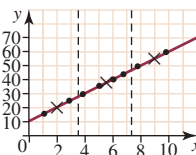
c The vertical intercept is the mass of the substance at 0°C , and the gradient is the amount by which the mass increases for each extra degree in temperature.

Exercise 12C — Fitting a straight line — the 3-median method

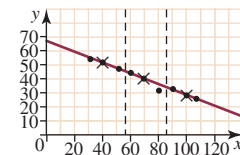
1



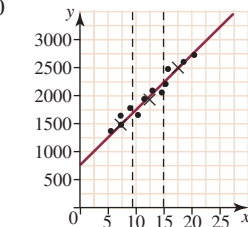
2 a $y = 5x + 10$



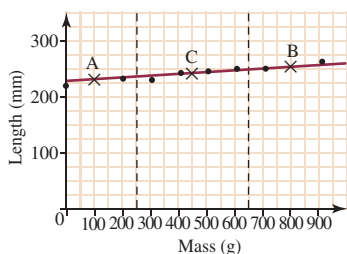
b $y = 68 - 0.4x$



c $y = 100x + 750$

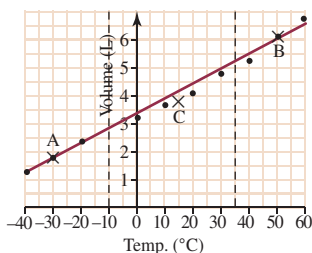


3 a



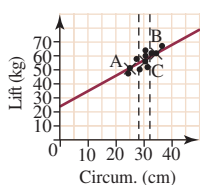
b $L = 0.048M + 221$

4 a



b $V = 0.05T + 3.3$

5 a



b $S = 1.1C + 24$

6 a

\$17.40

b

\$8.40

c

20 km

d

8.5 km

7 a

159.7 cm

b

178 cm

c

31.15 cm

d

25.74 cm

8 a

755

b

295

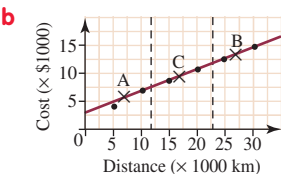
c

20°C

d

38°C

9 a, b



c $C = 0.4d + 2100$

d i

\$8100

ii

\$2500

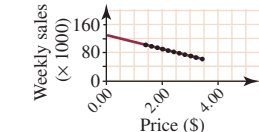
iii

14 750 km

iv

34 750 km

10 a, b



c $N = 133 - 20p$

d i

71 000

ii

41 000

e

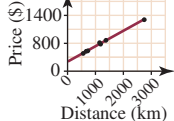
\$2.65

f

\$1.65

b $A = 0.46d + 270$

11 a



c i

\$573

ii

\$1227

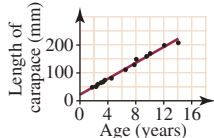
iii

\$732

iv

\$1745

12 a



b $L = 15A + 19$

c

94 mm

d

259 mm

e

3 years

f

109 mm

Note: Some answers may vary slightly depending on the location of the line of best fit.

13

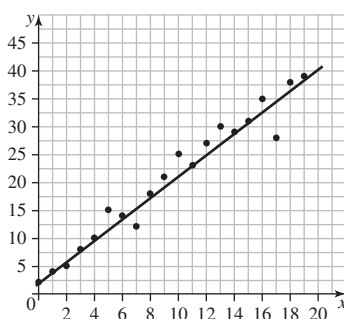
Total number of points	Lower third	Middle third	Upper third
7	2	3	2
8	3	2	3
9	3	3	3
10	3	4	3
11	4	3	4
12	4	4	4
13	4	5	4
14	5	4	5
15	5	5	5
20	7	6	7
25	8	9	8
50	17	16	17

14 D

15 $A = 80 - 4d$

16 $F = 13.13 - 0.04P$

17 a



b $y = 1.9x + 2.7$

Exercise 12D — Correlation

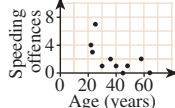
1 a Negative

b Positive

c Positive

2 a

b Negative



3 a Weak positive correlation

b Moderate positive correlation

c Strong negative correlation

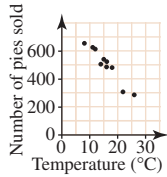
d Weak negative correlation

e No correlation

f Moderate negative correlation

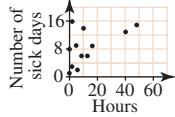
g Strong positive correlation

4 a



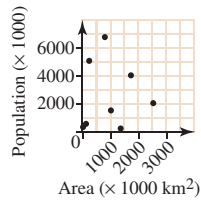
- b There is a strong negative correlation between temperature and the number of pies sold. As temperature increases the number of pies sold decreases.

5 a



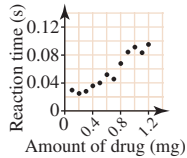
- b There is a moderate positive correlation between the time spent in airconditioned buildings and the number of sick days with colds and flu. As hours spent increases, there is often some increase in the number of days sick.
c More aspects would need to be examined.

6 a



- b There is no correlation evident.

7 a



- b There is a strong positive correlation indicating that increasing the amount of the drug given increases the reaction time.

8 C

9 B

- 10 a Perfect positive
b Weak positive
c Strong positive
d Moderate negative
e Weak positive
f No correlation
g Strong negative
h Moderate negative
i Weak negative
j Perfect negative

- 11 There is a moderate positive correlation.

- 12 There is a weak negative correlation.

- 13 a No correlation

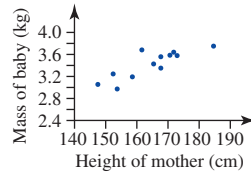
- b There is no evidence to connect money and happiness which confirms the statement.

- 14 a There is a weak negative correlation between obesity and exercise.

- b There is little evidence that connects the amount of exercise and obesity.

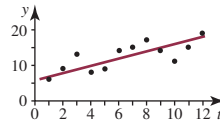
15 B

16 a



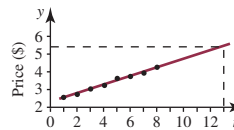
- b Moderate positive correlation

17 a



- b Moderate positive correlation

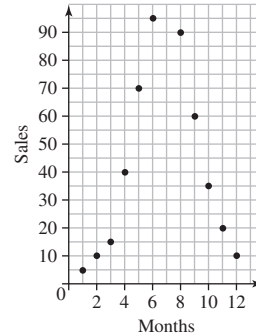
18 a



- b \$5.40

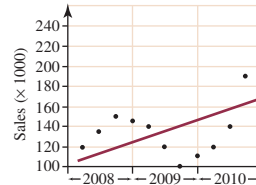
- c Strong positive correlation

- 19 a No correlation



- b The data is seasonal and, while more umbrellas are sold in winter, no linear trend can be fitted.

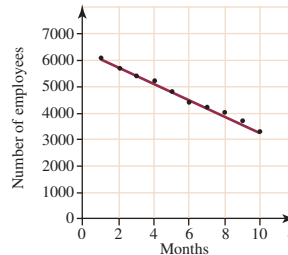
20 a



- b No correlation

- c The data is cyclical and, although there is a pattern evident, we cannot fit a linear trend.

21 a



- b Strong negative correlation

- c If this trend continues, the bank will have no employees, so it is reasonable to assume that the reduction in staff will level out.

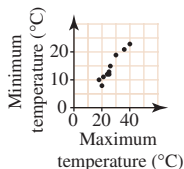
Chapter review

Multiple choice

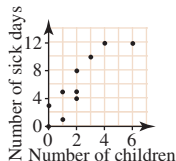
- 1 D 2 D 3 C 4 D 5 A

Short answer

1

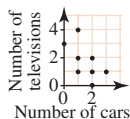


2 a



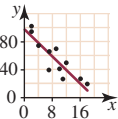
- b There appears to be a positive relationship which is linear.

3 a



- b There is no apparent relationship.

4 a, b

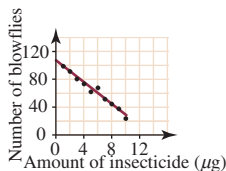


c $y = 99 - 5x$

5 a \$242 400

b \$73 000

6 a



b $F = 107 - 8I$

c 73

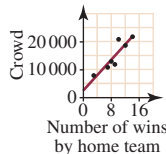
d 13.4 mg

7 a Negative

b Positive

c Negative

8 a, b



c Positive

9 a No correlation

b Perfect positive

c Moderate negative

d Strong negative

e Weak positive

10 a Strong positive

b Thicker beams cause greater strengths.

11 a Moderate negative

b There is some evidence that older people own older cars.

Extended response

1 a Yes, the median regression line is straight.

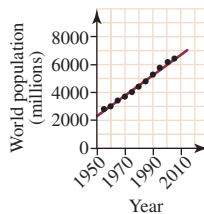
b i 713

ii 2.5 m

c i Positive

ii Moderate

2 a, b



c $P = 80Y + 2200$

d 7 billion

e 2050

CHAPTER 13

Spherical geometry

Are you ready?

1 a 69.1 cm b 88.0 m c 40 212.4 km

2 a 9.42 m b 25.6 cm c 41.5 m

3 a 2 hours 40 min b 210 minutes

c 28 days d $1\frac{1}{4}$ years

4 a 11.112 km b 43.20 M

c 7778.4 m d 4.07 M

Exercise 13A — Arc lengths

1 a 25.1 cm b 56.5 m c 389.6 mm

d 25.8 km e 87.3 km f 52.2 m

2 630 km

3 a 44.0 cm b 123 m c 188 km

d 368 mm e 11.6 km f 688 km

4 9400 km

5 31.83 cm

6 a 25.5 m b 6.73 cm c 796 km

7 8.73 cm

8 a 33.8 mm b 20.4 m c 150.8 cm

d 27.6 cm e 5.0 km f 20.7 km

9 a 40 200 km b 4470 km

10 a 52 km b 136 km

c Circumference of circle = $2\pi r = 188$ km = sum of two arcs

11 a 251 cm b 62.8 cm

12 a 5.2 cm b 4.3 m c 5696.8 km

13 112 km

14 a 15.9 cm b 4.25 m c 1910 km

15 30.6 cm

16 80°

17 a 54.5 cm b 102.5 cm

18 a $44^\circ 46'$ b $35^\circ 49'$

19 4940 km

Exercise 13B — Great circles and small circles

1 43.98 cm

2 a 56.5 m b 465 mm c 188 m

3 40 210 km

4 314 cm

5 a 15 320 km b 38 010 km

c 21 350 km d 449 200 km

e 378 690 km f 160 590 km

g 154 250 km

6 12.6 m

- 7 **a** 55.3 m **b** 40.2 m **c** 6911.5 km
B **9** 79 cm **10** 20 100 km
11 **a** 377 cm **b** 94.25 cm
12 **a** 1750 km **b** 52.4 m
13 **a** Great circle **b** Small circle
c Great circle **d** Great circle
14 **a** 50° **b** 38 cm **c** 239 cm
15 **a** Check with your teacher. **b** $r = 4.7$ cm, $C = 29.6$
16 **a** 6014 km **b** 4200 km
17 **a** 4525 km **b** 5924 km
18 Jude is correct. The distance XY is 7260 km, and the distance YZ = 3630 km, so XY is twice YZ.

Exercise 13C — Latitude and longitude

- 1 **a** Cairo **b** Shanghai **c** Darwin
d Montreal **e** London **f** Auckland
g Tokyo **h** Beijing **i** Rio de Janeiro
j Oslo
2 These answers are approximate.
a (38°S, 145°E) **b** (40°N, 75°W)
c (18°N, 76°W) **d** (26°S, 28°E)
e (42°N, 12°E) **f** (35°S, 57°W)
g (33°N, 44°E) **h** (55°N, 40°E)
i (2°N, 104°E) **j** (18°S, 178°E)
3 **a** Small circle **b** Great circle **c** Great circle
d Great circle **e** Small circle **f** Great circle
4 **a** 71° **b** 71° **c** 110° **d** 30°
5 **a** 162° **b** 132° **c** 159° **d** 140°

Exercise 13D — Distances on the Earth's surface

- 1 50°
2 **a** 40° **b** 40° **c** 71°
d 21° **e** 80°
3 60°
4 **a** 1800 M **b** 3334 km
5 **a** 2100 M **b** 8100 M
c 2340 M **d** 5760 M
6 **a** 3600 M **b** 6667 km
7 **a** 2700 M **b** 5000 km
8 6600 km
9 **a** 4356 km **b** 4021 km **c** 3798 km
10 D
11 B
12 7 hours 30 minutes
13 **a** 110° **b** 6600 M
c 12 200 km **d** 13 hours 45 minutes
14 10 800 M
15 **a** 28° **b** 1680 M
c 3111 km **d** 3128 km
e 1 M \approx 1.852 km and radius Earth \approx 6400 km. We are therefore working with approximations.
16 **a** (60°N, 20°E) (10°S, 20°E) **b** 3889.20 km
17 17 779.20 km
18 **a** 6889.44 km to South Pole
b 4555.92 km to North Pole
c 4889.28 km to North Pole
d 8889.6 km to South Pole
19 **a** 2482 km **b** 3247 km **c** 2872 km
d 427 km **e** 16 374 km **f** 6481 km
20 **a** 5243 km **b** 35° **c** 3203 km
21 (0°, 75°E)

Exercise 13E — Time zones

- 1 10 h
2 **a** 14 h **b** 7 h **c** 11 h **d** 22 h
3 11:00 pm Monday
4 **a** 8:00 pm **b** 1:00 pm Friday

- c** 5:00 pm Wednesday **d** 11:00 pm Tuesday
e 3:45 pm Monday
5 5:00 am Saturday
6 11:00 pm Tuesday
7 10:00 am Monday
8 **a** 10:00 pm **b** GMT + 11
c **i** 3:00 pm Monday **ii** 8:00 am Friday
c 17 h
9 **a** 18 h **b** 19 h
10 7 h
11 **a** 10 h 20 min **b** 24 min **c** 2 h 48 min
12 C
13 D
14 2:00 pm Tuesday
15 **a** 4:00 pm Wednesday **b** 8:00 am Sunday
16 **a** 1:00 am Wednesday **b** 3:00 am Wednesday
17 Midnight
18 **a** Noon Wednesday **b** 1 hour earlier
c 27 hours
19 **a** Check with your teacher **b** Sydney
c Add 7 hours and go back 1 day
20 **a** **i** 11.00 am to 7.00 pm **ii** 7.00 pm to 3.00 am
iii 12.00 am to 8.00 am **iv** 7.00 am to 3.00 pm
b The stock market is always open in some part of the world.
21 **a** The difference in their latitudes is so similar they are placed in the same time zone.
b Sydney is 150°E and Honolulu is 155°W, meaning that there is a 20-hour time difference. Honolulu is closer than London to Sydney but is on the opposite side of the International Date Line.
c When flying west across the International Date Line, you go back one day.

Chapter review

Multiple choice

- 1 A 2 C 3 C 4 C

Short answer

- 1 **a** 120.6 cm **b** 54.0 cm **c** 289.0 mm
2 **a** 6.3 m **b** 28.1 cm **c** 21.9 m
3 **a** 47.1 cm **b** 7.85 cm
4 **a** 207.3 cm **b** 44.0 cm **c** 57.8 m
5 56.5 km
6 71 cm
7 **a** 41.5 cm **b** 17.6 m **c** 9424.8 km
8 **a** Manila **b** Lima **c** Santiago
9 **a** (41°N, 3°W) **b** (1°N, 104°E)
c (43°S, 147°E)
10 58°
11 **a** 16° **b** 960 M **c** 1778 km
12 6 days 6 hours
13 **a** **i** 3060 M **ii** 5667 km
b 6.375 h
14 6000 km
15 **a** 8 h **b** 11 h **c** 17 h
16 3:00 am Thursday
17 3:30 am Tuesday
18 **a** 11:00 am the same day
b 11:00 am the same day
19 7:00 pm the same day

Extended response

- 1 **a** 85° **b** 9500 km **c** 8 h
2 **a** Small circle. They lie on the same small circle because they lie on the same parallel of latitude.
b 12:20 pm Saturday
c 9:40 am Wednesday.